JUL 9 - 1929

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

SEE PAGE 188

BRAND NEW

GENUINE *Model 3* CORONA

LOWEST PRICE
EASIEST TERMS
EVER OFFERED

$2.00 DOWN

HERE'S your chance to own that *brand new* Genuine Model 3 Corona you've wanted—on the easiest terms ever offered—at LOWEST PRICE ever offered. Complete in every detail; back spacer, etc., *Manufacturer's Guarantee.* Recognized the world over as the finest, strongest, sturdiest portable built.

Yours for 10 DAYS FREE

Send No Money

Leatheroid carrying case, oiler, instructions free on this offer. Send no money—just the coupon. Without delay or red tape we will send you the Corona. Try it 10 days. If you decide to keep it, send us only $2—then $3 a month until our special price of $39.90 is paid. Now is the time to buy. This offer may never be repeated. Mail coupon now.

Only a limited number of these splendid machines available. To get one, you must act now! Experience the joy this personal writing portable typewriter can give you! Use it ten days free! See how easy it is to run and the splendidly typed letters it turns out. Ideal for the office desk, home, traveling. Small, compact, light, convenient. Don't send out letters, manuscripts, reports, bills in poor handwriting when you can have this Corona at such a low price on such easy terms. Remember, these are *brand new* machines right out of the Corona factory.

Save Money *Use this Coupon*

Smith Typewriter Sales Corp., (Corona Division)
469 E. Ohio St., Chicago, Ill. Dept. 38

Ship me the Corona, F. O. B. Chicago. On arrival I'll deposit $2 with express agent. If I keep the machine, I'll send you $3 a month until the $37.90 balance of $39.90 price is paid; the title to remain with you until then. I am to have 10 days to try the typewriter. If I decide not to keep it, I will repack and return to express agent, who will return my $2. You are to give your standard guarantee.

Name

Address

Employed by

Pick the RADIO Job

you want . . . *and fill it in* 9 *months*

Radio Operator $90—$200 per month with all expenses paid. Broadcast Operator $1,800—$4,800 a year. Radio Repair Mechanic $1,800—$4,000 a year. Radio Inspector $2,000—$4,500 a year.

SPONSORED BY

RADIO INSTITUTE OF AMERICA

RCA

Radio pays from $2,000 to $25,000 a year. Get the "How" as well as the "Why" of Radio—with this expert training! Only an hour or so a day—in spare time—is all you need! The lessons prepare you for success in all phases of Radio—manufacturing, servicing, selling, ship and shore broadcasting, Television and Photo-radiograms. A signed agreement backed by RCA assures you of complete satisfaction upon completion of the training—or your money will be promptly refunded.

Radio Institute of America
Dept. P. M. 8
326 Broadway, New York, N. Y.

Gentlemen: Please send me your big FREE 50-page book which tells about the brilliant opportunities in Radio and about your famous laboratory-method of guaranteed radio instruction at home.

Name.....

Address.....

MAKE MONEY AT HOME!

Painting photos and miniatures. No talent required. Fascinating work. **Make $25-$100 a week.** Earn while learning. We teach you at home. Professional artist's outfit, employment service, given. Write for FREE book TODAY. **NATIONAL ART STUDIOS, 1008 N. Dearborn, Dept. 24-S, Chicago.**

TELEGRAPHY

Morse and Wireless and RAILWAY ACCOUNTING, taught thoroughly. Big salaries; great opportunities. Oldest, largest school. Endorsed by Telegraph, Railway, Radio, and Government officials. Expenses low—opportunities to earn large portion. Catalog free. **DODGE INSTITUTE, Jones St., Valparaiso, Ind.**

WANT A GOVERNMENT JOB?

Railway Postal Clerks

Mail Carriers—Postoffice Clerks

No Layoffs—Vacations—Common Education Sufficient

$158 to $225 a Month

Mail Coupon Before You Lose It

FRANKLIN INSTITUTE, Dept. W158
Rochester, N. Y.

Sirs: Rush to me without charge—copy of 32-page book "How to Get U. S. Government Jobs," with list of positions obtainable and full particulars telling how to get them.

Name.....

Address.....

Men! Extra Money Quick

Here's An Easy Way!

—to bring you a fine cash income! Without taking any time away from your job. Pleasant easy work at home. Decorate beautiful giftwares the Fireside way. **You can do it—in spare moments.** No previous training required. No special ability needed. No tedious study. No memorising. With the Three Simple Steps sent you by Monsieur Petit the great artist—Director of Fireside Industries, it is just fun! We want men in every community. Be the first! **Fireside Industries, Dept. 66-K, Adrian, Mich.**

Begin Right Now!

Thousands are making Fireside Decorations—making from hundreds to thousands of dollars and doing their own work besides. We supply you with everything you need. Big Generous Complete Kit WITHOUT EXTRA COST. It's a cinch! We absolutely guarantee your success.

FREE!

Fill out and mail coupon at once. Without any obligation it brings you wonderful Fireside Book in colors. Explains everything.

Act now!

Fireside Industries,
Dept. 66-K, Adrian, Mich.

Send me your wonderful Free Book in colors. This does not put me under any obligation.

Name.....

Address.....

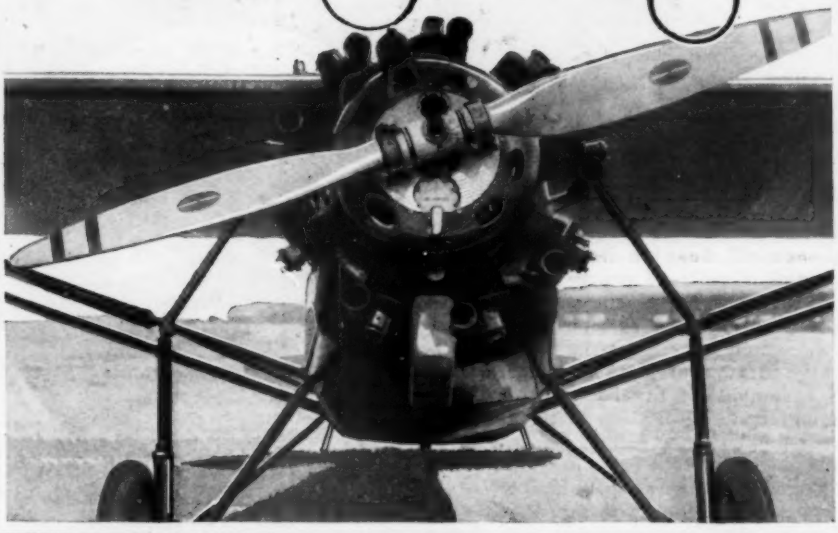
Photo by Ewing Galloway

Lower Manhattan's Skyline as It Appears from Governor's Island, Looking from the Southeast; High as These Towers Are, Even Loftier Ones Are Being Planned and the 100-Story Skyscraper Will Be a Commonplace within a Few Years, Engineers Predict—See Page 210

Popular Mechanics Magazine
REGISTERED IN U. S. PATENT OFFICE
WRITTEN SO YOU CAN UNDERSTAND IT
Vol. 52 AUGUST, 1929 No. 2

Lower Manhattan's Skyline as It Appears from Governor's Island, Looking from the Southeast; High as These Towers Are, Even Loftier Ones Are Being Planned and the 100-Story Skyscraper Will Be a Commonplace within a Few Years, Engineers Predict—See Page 210

The Latest Sky Engine



Front View of the Air-Cooled, Diesel-Principle Airplane Motor That Burns Ordinary Fuel Oil Instead of Gasoline and Requires No Carburetor or Spark Plugs

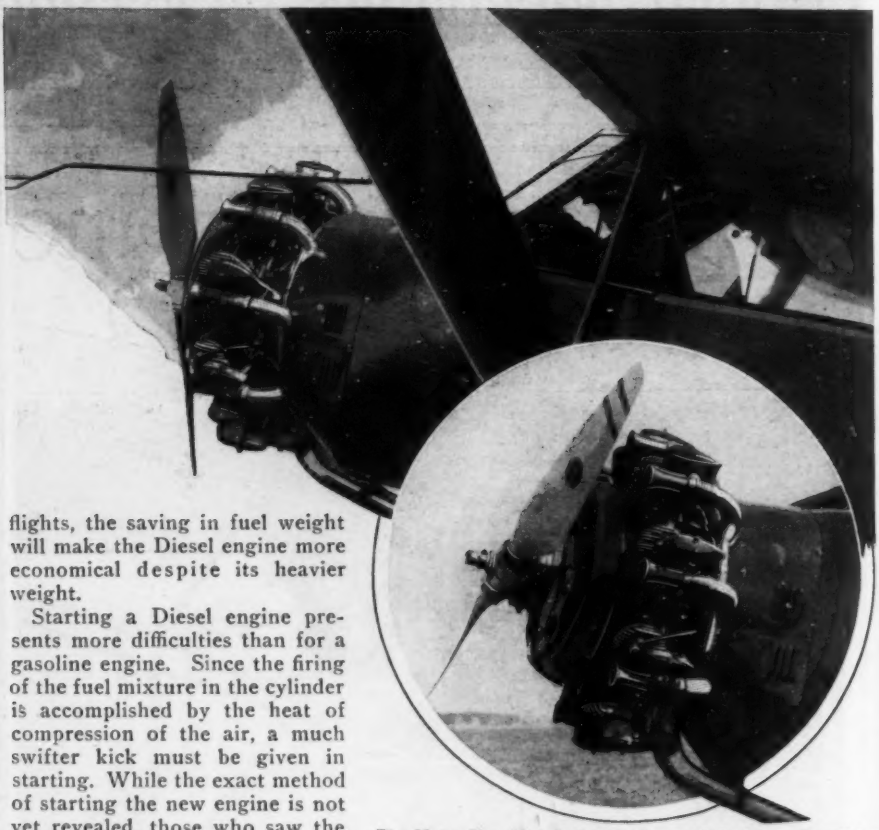
By CORLEY McDARMENT

AT LAST a new type of aircraft engine has appeared in the sky. It is an air-cooled radial motor operating on the Diesel principle. It has no ignition system and no carburetor, and it burns ordinary fuel oil.

On its first 560-mile flight, the fuel cost was exactly $4.68! The motor uses about eight and one-half gallons of oil an hour.

Nine cylinders compose the new engine. One valve in each cylinder head acts as air inlet and burned-fuel exhaust. The fuel, oil instead of gasoline, is sprayed into the cylinder instead of being mixed with air and vaporized in a carburetor. The heat of compression of the air in the contracting cylinder ignites the oil sprayed into it. Thus electrical ignition is dispensed with. The engine is of the four-stroke type and operates at from 1,700 to 2,000 revolutions per minute with cylinder pressures as high as 1,200 pounds.

For a given mileage, the fuel cost is only about a sixth that of a gasoline engine. The present design weighs about three pounds per horsepower, a remarkable record despite the fact that the corresponding weight for standard gasoline airplane engines is less than two pounds. Engineers have estimated that, for long



The Motor Has Nine Cylinders, Arranged Radially; One Valve in Each Cylinder Head Acts as Air Inlet and Burned-Fuel Exhaust

flights, the saving in fuel weight will make the Diesel engine more economical despite its heavier weight.

Starting a Diesel engine presents more difficulties than for a gasoline engine. Since the firing of the fuel mixture in the cylinder is accomplished by the heat of compression of the air, a much swifter kick must be given in starting. While the exact method of starting the new engine is not yet revealed, those who saw the Langley field demonstration are of the opinion that the necessary impulse is given by the firing of a powder cartridge. Once the engine is warmed by running, it can be stopped and started in the conventional manner.

Ignition and carburation have always been the chief causes of motor failure with the gasoline motor, and a type of engine which eliminates these two causes for worry should be welcomed in the field of aeronautics. The fire hazard also is cut to the minimum, as gasoline is so much more inflammable than oil.

The new engine has been under development for many months in the laboratories of the Packard Motor company. The designer is Capt. L. M. Woolson, who was in the army air service during the World War. The great problem which has balked so many manufacturers and designers who would have brought out such a motor long before, was the extreme difficulty of getting all the Diesel principles squeezed into one chunk of iron, small enough and light enough to make an efficient aircraft engine.

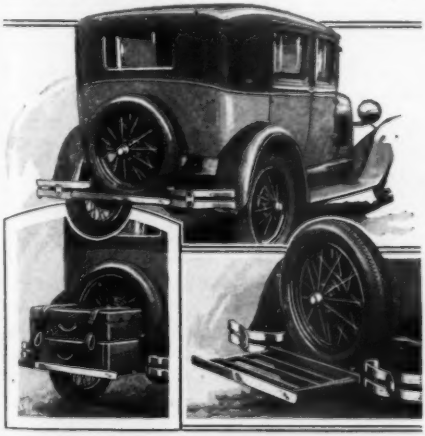
Whittling weight off motors is a dangerous thing, and more than one promising engine has been shaved a thousandth of an inch too close, causing breakage. One light and powerful aircraft engine was made once which literally shook itself to pieces in the air. The Diesel principle sounds simple: Just squirting a little oil into a cylinder, squeezing it until it flashes and throws the piston back—but try to do it.

OUTBOARDS INSTEAD OF SAILS SOLVE YACHT PROBLEM

Two outboard motors lashed to either side of the after deck solved the problem of moving the "Margaret F IV," a racing yacht, from New York to Buffalo, via the Erie canal. When it was decided to move the craft to its home port at Detroit, it was found the hull was too high to be shipped by rail, too expensive to tow, and too awkward to attempt to sail, particularly through the locks and canals. The difficulty was solved by bolting two timbers across the after overhang, and to the outrigger were attached two outboard motors, the masts being cradled on the deck to allow the craft to be sailed from Buffalo to Detroit.

TRUNK RACK BECOMES BUMPER WHEN NOT IN USE

Attached to the "bumperettes" of the model-A Ford, a luggage carrier, when not in use, slides under the car, the rear end tying in with the bumperettes to form added protection for the rear of the car. The disappearing trunk rack, by being attached to the bumpers, is installed without disturbing the position of the extra tire, thus making unnecessary a side-fender well mounting to carry the spare. When closed, the end of the luggage rack forms a bumper bar extending the width of the back of the car.



Disappearing Luggage Rack Slides under Car to Become Part of Bumper When Not in Use

Pistol Used in Shooting Life Lines to Persons on Sinking Vessels or in Water

ROCKET PISTOL SHOOTS LINE TO SAVE SEA VICTIMS

Shooting life lines to victims of sea disasters by means of a rocket pistol has been accomplished successfully. The unit was demonstrated at a recent safety convention in London. It has a considerable range and is chiefly suited to the equipment of a rescuing vessel because of its small size.

OPERA "CANNED" ON MOVIE FILM FOR HOME REPRODUCTION

An entire opera may be reproduced on a strip of movie film forty feet long, according to plans of General Electric engineers. The film is similar to the usual picture variety but is intended for music or speech only and, when inserted in the proper machine, will play without a stop for two hours or so. The lines are extremely small so that a great number can be registered within comparatively little space. It is hoped that the device may be found useful for recording the speeches of eminent men, operas by great stars and lengthy pieces of music.

Golf-Club Carrier Has a Compartment for Each Club and Stands Upright, Allowing Easy Selection

GOLF-CLUB CARRIER CONTAINS RACK FOR EACH CLUB

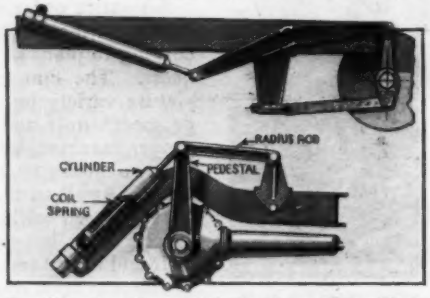
Containing an individual rack for each club and spring clips for balls, a golf-club carrier has been designed to simplify the carrying and selection of the player's treasured woods and irons. It weighs but four pounds, is constructed of aluminum and bakelite, and a support enables it to stand upright on the turf with all clubs in plain view. The bottom of the carrier contains sockets of varying depth so that club heads are at uniform height, and the top is equipped with rubber-lined channels which hold the clubs apart. A gate keeps the clubs firmly in position and a button releases it for selection of a club. Around the top rim are the spring clips for the balls. The carrier has a handle and shoulder strap for carrying on the course, and a zipper case for transportation off the course has space for extra clubs. Clubs held rigidly in the carrier are kept from warping, and the handle is located in such a manner as to give perfect balance in carrying.

RAILROAD CAR AS "DETECTIVE" HELPS IMPROVE TRACK

Smoother rides are made possible on the Atchison Topeka and Santa Fe railway with the aid of a track-recording car that registers and locates low joints in the rails, and other defects, under operating conditions. The car is equipped with apparatus which shows how much it inclines one way or the other as it rounds a curve, tells of the track conditions and records the information on a moving strip of paper as the train proceeds. The report is an accurate picture of the section tested, and gives foremen and other officials a reliable guide by which repairs may be made. An interesting feature of the equipment is a gyroscope which establishes a constantly horizontal plane for the measurement of the track cross level and the amount of car tilt, regardless of the movements of the train. The car is run over approximately 10,000 miles of the railroad company's track each year. Since the tests can be made at different speeds and at different times of the year, they are of increased value.

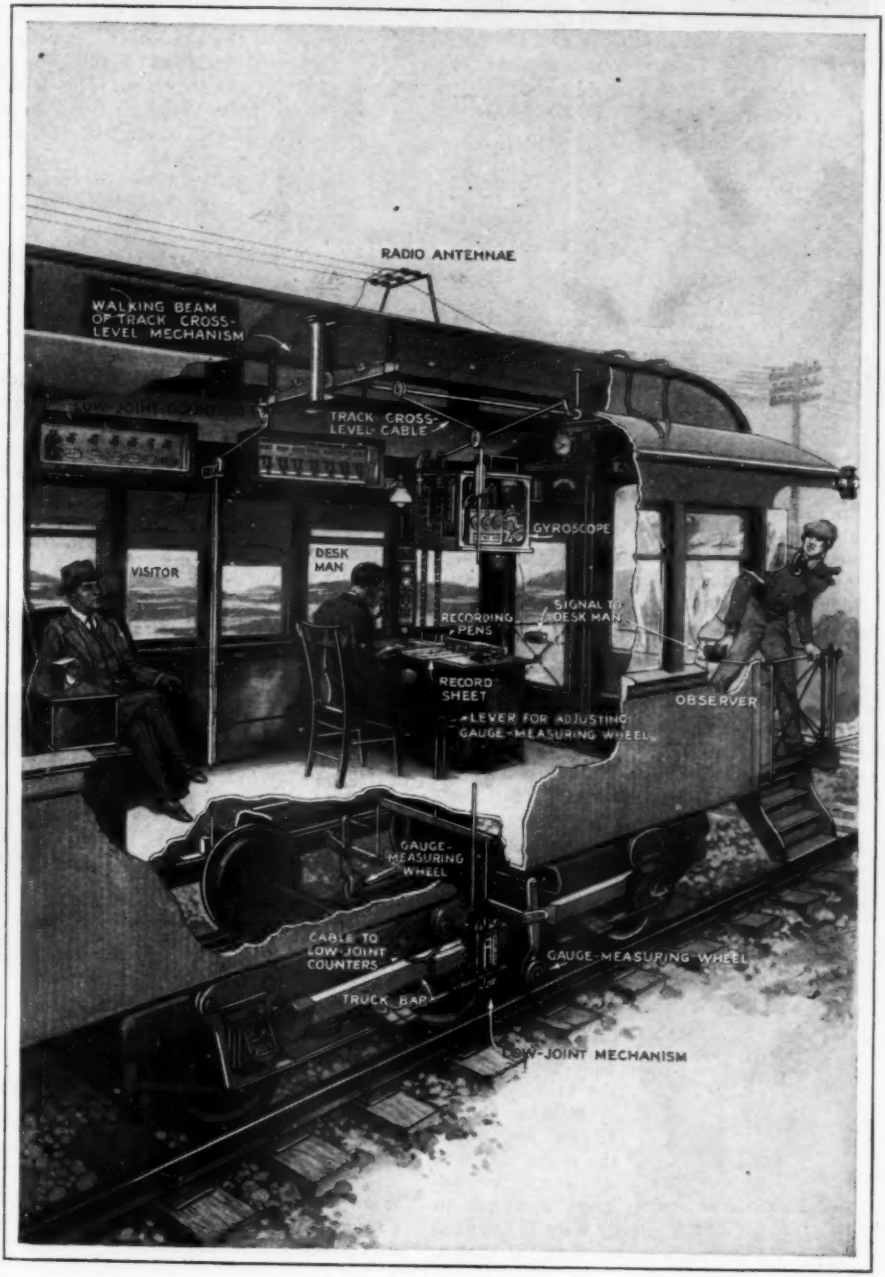
SMOOTHER RIDES IN LIGHT AUTO ON IMPROVED SUSPENSION

Devised especially for lightweight automobiles, an improved suspension system developed in England, operates in such a way that it is said to be equivalent to stiffening a spring in proportion to the load which it has to carry. This is accomplished by a pedestal, radius rod and coiled spring in place of the usual leaf spring. As the axle is deflected toward the car in going over bumps, the leverage changes continuously, giving more purchase for the spring. According to reports of tests with the installation over rough roads, there was a high degree of comfort, without jolts or jars, and the wheels of the car followed irregularities without bouncing.



Drawings of the Improved Spring Suspension, to Show How Leverage Changes Continuously

EVERY BUMP REVEALED BY TRACK-RECORDING CAR



Girl Sending Stock Quotations, and, Right, the Messages Recorded Automatically on the Electric Board in a Distant Broker's Office

STOCK PRICES ARE FLASHED ON ELECTRIC BOARD

Brokers' offices where stock-market fluctuations have been chalked up on blackboards by clerks now are installing electrical quotation boards operating automatically. Price changes on the automatic blackboards, known as teleregisters, are flashed from the offices of a telegraph company by ticker into the brokerage office, and the new board operates electrically to record the price change beneath the stock affected.

BALLOONISTS AVOID LIGHTNING IN SHIELDED BASKET

Lightning has been conquered as far as the occupants of a balloon basket are concerned. They are protected by a shield offering a better path for the discharge than that through the man's body. Instead of the customary wooden loading ring through which pass the ropes to the basket, a metal ring was substituted, and from the metal ring two diagonal cross-arms extend, to the ends of which copper wire is fastened forming a rectangle larger than the basket.

From the rectangle strands of copper wire drop down, thus incasing the balloonist in a copper shield, as far as lightning is concerned. The device has been tested with artificial lightning, and instruments placed in the basket showed no electrical discharge entered.

NEW SHIP CANAL FOR CANADA

Deep-water navigation between Cornwall and Lachine in the provinces of Quebec and Ontario will be provided by a proposed fourteen-mile canal that will also make available some 500,000 horsepower in hydroelectric plants. The canal will be 600 feet wide at the bottom and will have a depth of twenty-seven feet. This can be increased to thirty, should conditions demand.

BINDER WITH FLEXIBLE POSTS SAVES TIME IN FILING

Filing of records and papers has been simplified by the use of a binder with flexible-link posts which do not extend beyond the covers of the binder, thus saving space in filing cabinets. When opened, the binder automatically gives a two-inch working space. A key compresses or releases the binder and its contents.

SOLDER METALS TO PORCELAIN

Metals now may be soldered to porcelain by a process which gives a joint that will hold a high vacuum. Being metallic, it will not take up water, and being a good conductor, it equalizes insulating stresses on the porcelain near it.

The Vanishing Stack

Streamline Designing Enters Railroading; One of the Latest Delaware and Hudson Passenger Locomotives That Can Haul Seven Cars Ninety Miles an Hour

THE SHAPE and size of a locomotive smokestack will place the date of the building of that engine within a decade or two, at most. In former times, the smokestack was the most conspicuous part of the engine. Through a series of gradual changes, it has evolved from a tall, straight, stovepipe-like affair, almost as large as the boiler itself, down to a little sawed-off stack some eighteen inches high, set on top of a boiler which has grown in inverse proportion a dozen times over. In other words, as the boiler has grown larger the smokestack has grown smaller.

It all commenced way back in 1830 and 1831 when the first railroads were making their appearance in this country. Engines then, and for a long time afterward, were scarce enough to be named instead of numbered. They had personality. Take the "DeWitt Clinton," for example, the first engine to run in New York state, over what is now the New York Central railroad, pulling a little train of renovated stagecoaches. Its first run was between Albany and Schenectady—eighteen miles. And the passengers riding on top of the coaches, as many stagecoach passengers had done in the past, were treated to a sort of baptism of fire from the tall puffing stack of the laboring engine in front. Top hats and crinolines suffered badly. More than that, farmers and property owners along the way complained bitterly that their fields and fences had been set afire by glowing chunks of wood and embers.

Now the builders of that first engine had not thought of such a contingency. They had adopted a smokestack like that on every existing horizontal engine—a steamboat engine or stationary engine. But the railroad people knew, after the first two or three runs, that something must be done to prevent the flying sparks from playing havoc along the property which bordered their right of way. They were seeking the good will of the people and instead they were creating antagonism. Someone suggested that a wire netting be stretched across the top of the stack, so that the sparks, on being carried by the draft up the stack, would strike against it and fall back into the smoke box at the base and at the front of the boiler. It was tried, but did not prove thoroughly

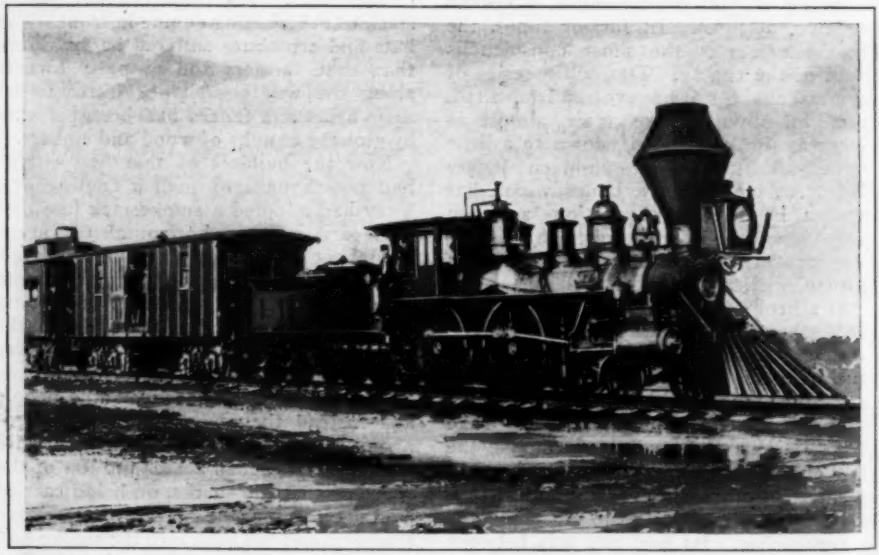
satisfactory because the sparks fell back in the stack and clogged the fire tubes.

The next step was an attempt to catch those annoying sparks and hold them in the stack so they would not fall back and clog up the tubes. To accomplish this, a huge funnel, or balloon, was placed around the central stack. The stack itself extended up through the center of this "bulge" to a point within a few inches of the level of its top. A big piece of netting was placed over the top of the funnel, so that now the sparks and embers struck the netting with considerable force and fell over to the side in the funnel. It was in reality a spark chamber, and for twenty years or more it served very well.

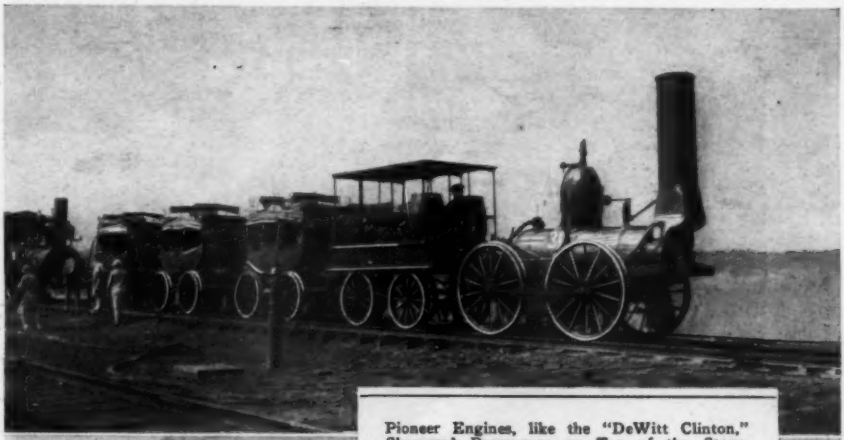
The diamond stack followed the funnel or balloon stack along in the eighties, at about the same time coal superseded wood as fuel. It possessed some of the features of the balloon stack, but had one great advantage: It was in reality a sort of coffee grinder, a big collar, shaped like a diamond, around the top of the stack, into which the sparks were deflected by an inverted fluted cone placed just under the netting. The draft whirled the sparks around in the grinder until they were pulverized sufficiently to pass harmlessly out through the netting, too nearly extinguished to set fire to anything.

But still the problem of getting rid of the sparks safely for all concerned remained to be solved. The big era of railroad building was just entering its zenith, and progress in engine construction was going forward rapidly. The heavier trains demanded larger locomotives to pull them. Yet they could not be built with higher smokestacks, such as would be necessary to take care of the sparks, or they would not be able to pass under the bridges and through the tunnels.

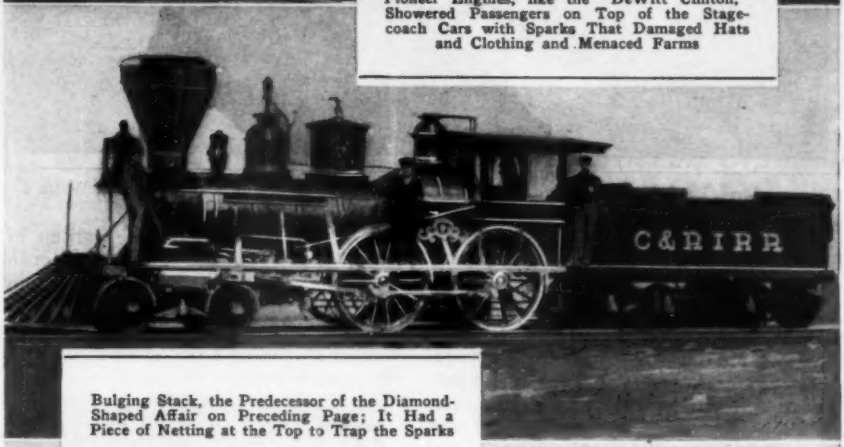
And so, as a result, the first "extension front" engine made its appearance. In this new type, the netting is placed, not in the stack at all, but down in the smoke box to the forepart of the boiler. Ever since that time (about 1888), the smokestack has performed no other function than that of a pipe to carry away the sparks which the draft has pulverized by beating them back and forth on the netting placed at an angle inside the smoke box. Though for a time engine builders clung to the idea that it was necessary to have a flared, purely ornamental collar around the top of the stack, that reminder of old times has given way entirely to a plain stack.



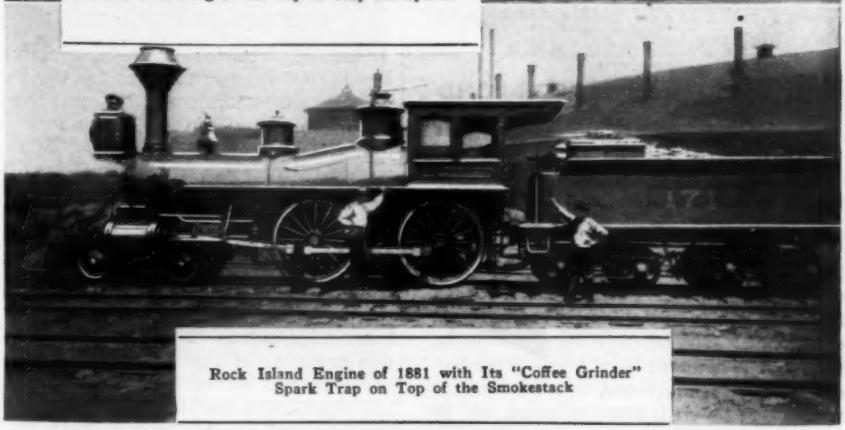
When the Locomotive Smokestack Was About the Biggest Thing on the Engine; the Bulge Was Thought Necessary as a Trap to Catch the Sparks



Pioneer Engines, like the "DeWitt Clinton," Showered Passengers on Top of the Stage-coach Cars with Sparks That Damaged Hats and Clothing and Menaced Farms



Bulging Stack, the Predecessor of the Diamond-Shaped Affair on Preceding Page; It Had a Piece of Netting at the Top to Trap the Sparks



Rock Island Engine of 1881 with Its "Coffee Grinder" Spark Trap on Top of the Smokestack

These Spheres, Resembling Huge Baseballs, Are Part of a Battery of Sixteen Steel Condensers Which Store Excess Steam for Future Use in a German Electrical Works

EXCESS STEAM POWER STORED FOR EXTRA DEMAND

In order to make available the great surplus steam power generated during leisure hours of operation of the state electrical works at Charlottenburg, Germany, a battery of sixteen huge steel condensers has been constructed. When needed, the condensers make available this extra power under high pressure.

METAL BASIN AS GARDEN POND REDUCES EXPENSE

Easily installed and requiring practically no maintenance expense, a metal basin has been introduced for small garden ponds as a substitute for masonry-lined pools. It is made of a copper-steel alloy and is coated with a specially prepared cement paint, to resist corrosion and insure long service. The basin can be placed in the garden in an hour and is easily moved. It cannot crack or rot and is provided with an overflow pipe if running water is used, although satisfactory results are reported simply by adding a pail or so of water once or twice a week.

HIGH-SCHOOL BOY SIMPLIFIES ENCYCLOPÆDIA TEXT

Complete revision of the Encyclopædia Britannica, the fourth since the Civil war, now nearing completion, has entailed the writing of about 30,000,000 words of new material and the salvaging of 6,000,000 words of material from the old edition. The task, equal to the printing of at least 300 novel-length books and the re-editing of sixty more, is being carried on concurrently in New York and London, while the printing is being done in Chicago. So greatly has the world and its sum of knowledge altered that more than eighty-five per cent of the material is new and more than 2,500 of the world's thinkers and doers have contributed to it, nearly all the material having been written in the

past year. One of the three final readers to pass on the corrected proofs is a high-school boy. If, after careful perusal, he is unable to comprehend an article, the author or the editors must clarify it so the boy is able to understand it. New subjects treated include war guilt, the biology of death, the league of nations, mass production, bolshevism, theatrical production, the electron, radioactivity, broadcasting, shop-front design and philanthropy. The how-to-do-it article marks perhaps the greatest change in the revised edition as compared with the old, and the searcher after information may read how to build skyscrapers, batik silk, hammer brass or carve wood.

BANK CLERKS TAUGHT TO SHOOT AND DISARM ROBBERS

Bank clerks of Portland, Oreg., are taken to a target range to train them to cope with robbers in case of a holdup. The bank employes not only learn how to shoot, but how to disarm a robber and turn his own weapon against him. A teller's window has been set up on the range, and the clerks are taught what to do when suddenly confronted by an armed man. An instructor also teaches them the Japanese method of relieving an opponent of a weapon by grasping and twisting the hand in which the weapon is held.

A Teller's Cage on a Rifle Range Used to Teach Bank Clerks to Cope with Robbers

This Ancient Suit of Chinese Armor Incases a Clock, Chinese Gods Marking the Numerals

CLOCK BUILT IN SUIT OF ARMOR SIX HUNDRED YEARS OLD

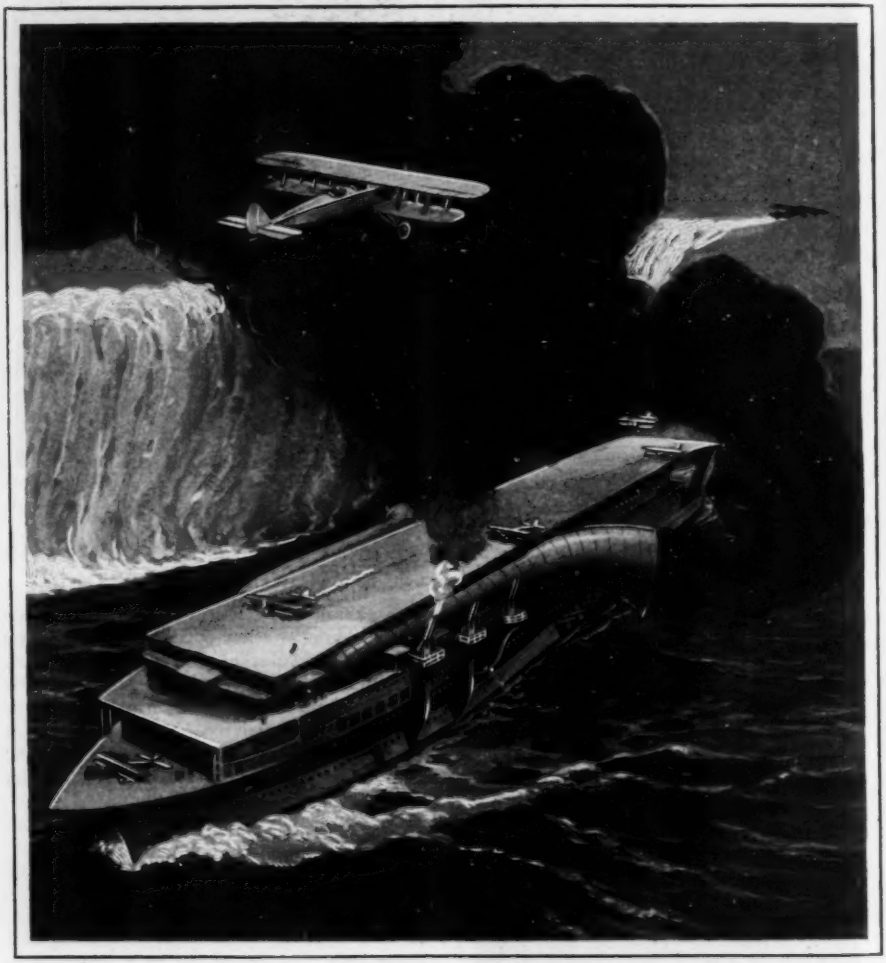
A curious clock, built into a suit of Chinese armor at least 600 years old, is one of the prized possessions of a New York clockmaker. On the grotesque knight's chest appears the face of the clock with Chinese gods, such as the god of light and the god of the sun, used for numerals. Inside the armored breastplate is the mechanism of the timepiece.

BLIND MAN'S CAMERA MAKES PRINTS AT SAME TIME

A rapid camera that not only takes pictures but makes prints at practically the same time, has appeared in London, the invention of a blind man. It has two lenses, one of the ordinary camera variety and the other admitting only ultraviolet rays. Films and paper are inserted together. Whenever the shutter is opened, a small quantity of "gas" of a secret nature, the developing material, is released from a small cylinder, to develop, fix and print the exposures. When the spool is removed, the photos are unwound, too.

¶The so-called century plant sometimes takes forty-five years to bloom.

AIRCRAFT CARRIER HAS FUNNELS LIKE BIG TRUNKS



Drawing of the "Kaga," Japan's Mighty Aircraft Carrier, Showing the Huge Funnels on Either Side for Producing Smoke Screens and Keeping the Fumes Away from the Landing Platform

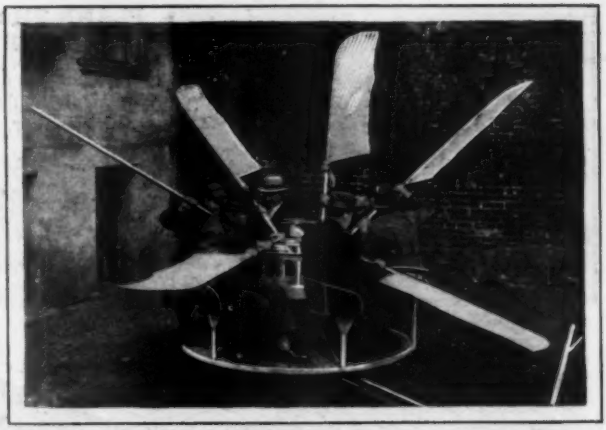
Capable of carrying sixty airplanes and with curiously arranged funnels that may be employed in laying protective smoke screens, the "Kaga," one of the latest additions to the Japanese navy, is soon to be placed in service. It was originally intended as a battleship of 40,000 tons but was remodeled to displace 28,100 tons as an aircraft carrier to steam at twenty-nine miles an hour with 91,000-horsepower engines. The shape and position of the funnels serve a double purpose. They lead the fumes away from the landing platform so that there will be less interference with flying and at the same time permit the formation of a smoke screen at either or both sides of the vessel. Aided by planes, the carrier would have exceptional facilities for hiding itself from the enemy. Another airplane carrier in the Japanese navy, the "Akagi," has two large smoke funnels, both opening on the starboard side.

TILE IS MADE FROM SAND

Building material resembling tile in some respects and like marble in others is being manufactured at New Orleans from river and lake sand. The material, known as muralite, is made in dull and gloss finishes and in various colors, and is used in interior or exterior construction in the same manner as tiling, facing and wallboard. Its makers say it has greater tensile and crushing strength than marble, is fireproof, has no cleavage line and hence does not crack. It is made without heat or pressure, its formation being the result of chemical reactions on the raw materials, the latter including, besides the sand, dust from stoneworking establishments and sweepings of sand from iron foundries.

A WORLD FLOOD?

Scientists have evolved a plausible theory giving a basis in fact for the ancient tradition among all primitive people of a world-wide flood which covered the earth thousands of years ago. The cause of the ocean's rise may have been the melting of the ice cap at the north pole at the end of the last ice age, about 20,000 years ago. One of the purposes of the Byrd expedition is to determine whether the antarctic ice barrier is melting. Sir Edgeworth David, Australian geologist, has estimated the level of the entire ocean would be raised about fifty feet if the whole ice barrier about the south pole melted. This would place nearly every seaport town under water.



Passengers Furnish Their Own Motive Power for This Merry-Go-Round by Operating Wings Which Set It Whirling

WINGS FURNISH MOTIVE POWER FOR MERRY-GO-ROUND

Passengers in a novelty merry-go-round being used in Germany furnish their own motive power and at the same time get some of the thrills of "ground flying." The passengers operate the machine by raising and lowering birdlike wings attached in front of the seats, the wings operating in unison to set the merry-go-round whirling.

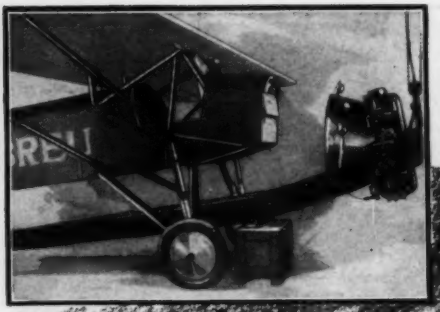
HORNED TOADS AS TRAINED PETS POPULAR IN TEXAS

Once considered an unwelcome pest, the horned toad is today esteemed in Texas and other parts of the country. They are trained to do tricks, participate in races and make amusing playthings for children, who teach them to draw toy wagons and perform other stunts. One Texas woman has a "herd" of fifty toads, and a man has built up a large business raising them and shipping them to various markets. Aviators often carry them as mascots.

Proving That Horned Toads Make Good Pets; Two Have Been Trained to Haul Toy Wagon

PLANE THAT DROPS ITS ENGINE TO PREVENT CRASHES

Successful demonstration of a detachable airplane, developed by a San Francisco cabinetmaker, suggests a further means



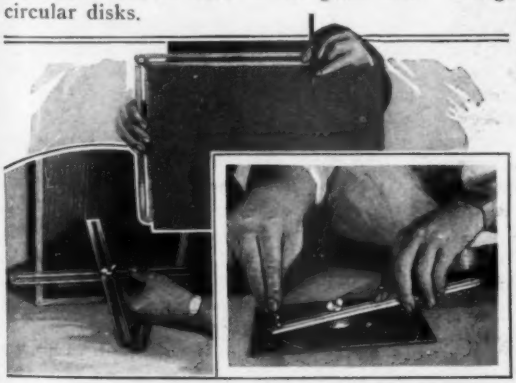
Drawing to Illustrate the Motor-Release Idea in Operation, and Photograph of One of the Planes Tested

of promoting safety in aviation and speeding the air-mail and other flying schedules. In case of fire or other mishap during a flight, the pilot pulls a lever, releasing the motor and fuel tanks. They fall to the ground, while the rest of the plane with its operator and passengers is steered to a landing as a glider. In a test of the plane over the Alameda airport, the motor was released at an altitude of 5,500 feet. The pilot, operating the engineless ship as a glider, soared slowly toward the ground for more than fifteen minutes before heading for the runway. Children running toward the incoming craft forced him to nose it into the sand, but the ship was only slightly damaged. Besides being of a great advantage in case of a fire, the detachable arrangement would permit the rapid change of motors on planes before

taking off, thus making it unnecessary to transfer cargoes of mail and other loads to a different plane The idea has been adapted to the release of engines on multi-motored planes. Dirigibles have been planned, fitted with planes that could be released and flown away, to replace the regular passenger gondolas in cases of accidents or danger.

CARPENTER TOOL SERVES MANY PURPOSES

A tool that can be used to replace a dozen or more separate devices is the latest accessory for the carpenter's kit. It consists of a pair of slotted steel rulers, each laid out as a twelve-inch rule, and held together by a clamp and wingnut. Drawn out and locked in a straight line, the two parts form an accurately machined rule, two feet in length, and locked at right angles, they form a try-square. They also are marked and slotted to be locked at thirty, forty-five and sixty-degree angles, as a T-square, and can be set at any angle for use as a miter square. Set in other ways, they form a depth gauge, an inside rule, a marking gauge, adjustable extension rule, and a compass A rubber suction cup is furnished to fit into the hollow stem of the locking post, and with this in place and a glass cutter clamped between the ends of the rules, the device can be used to cut glass into circular disks.



Two Slotted Steel Rulers Clamped Together with a Wingnut Make Try-Square, Compass, Glass Cutter and Other Tools

Offering Home Seekers a Bargain; Old Railroad Coach on Sale for Use as Bungalow, Summer Cottage or Lunch Wagon

OLD RAILWAY COACHES SOLD FOR BUNGALOWS

Coaches no longer fit for active service are placed on sale at a station on the Central railroad of New Jersey. As the sign indicates, the price is moderate and the coach is suitable for adaptation as a lunch wagon, a summer or vacation bungalow. Trucks and seats are not included.

AVERAGE AIR-TRAVEL CHARGE IS ELEVEN CENTS

Eleven cents per mile is the average charge for passenger air travel over the regular transport lines in the United States, a survey by the Boeing Air Transport reveals. It is possible for a passenger to travel 12,914 miles over air-transport lines operating regular passenger service without retracing the route once The cost of such a trip would be $1,427. The lowest passenger fare was found to be 7.6 cents a mile between Portland and Seattle, and the maximum was 21 cents a mile for a short trip over the ocean along the Pacific coast. The rates included taxi-cab or bus transportation between the airports and the business sections of the cities.

AUTO LAMPS LIGHT AIRPORTS AT LOW COST

Towns and small cities having airplane-landing fields, are finding an economical way to provide lighting facilities by employing batteries of automobile headlights. The cost is but a fraction of the more elaborate lamps specially made for airports, and yet they afford excellent service. The accompanying illustrations show a typical installation and the degree of illumination provided. Ten spotlights and three oval lights, such as are used on automobiles as backing or fog lamps, make up the equipment.

Battery of Automobile Headlights Used to Illuminate an Airport, and Night Photograph of the Field

AIR MIXED WITH GASOLINE CUTS DOWN VOLUME

When the motorist buys gasoline at the filling station does he get all fuel or is he paying for part air? If the gasoline is saturated with air under pressure, it has been found, and this pressure is released, the air may form fine bubbles in the gasoline and the volume may therefore be much larger, due to the bubbles displacing some of the liquid. Under such conditions, to be sure of accurate metering of the gasoline, it would be necessary that no air bubbles be present while the liquid is passing through the meter. It is stated that a volatile aviation gasoline will dissolve about one-quarter of its own volume of air, if exposed to the atmosphere, while a motor gasoline will dissolve about one-sixth of its volume of air at ordinary temperatures. Because of the tendency of air to become mixed with gasoline, the height to which it is feasible to pump the liquid by a suction lift is dependent not only upon the volatility of the gasoline but also upon the amount of air in solution.

FISHING POND ON ROOF TOP

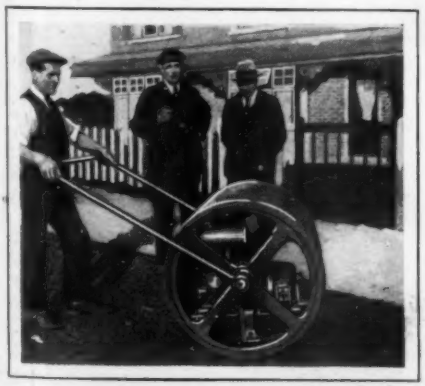
Business men who like to fish but have no time to go on fishing trips, may have their yearning for the sport satisfied in Portland, Oreg., by taking their tackle to the top of a high office building. The roof has been made into a fishing pond with shrubbery about the edges, to give the effect of a mountain stream. Casting is one of the favorite sports, and the pool has different depths so the angler may select the spot he likes best.

LETTERS THROWN INTO OCEAN DELIVERED BY CURRENT

Mailing letters by throwing them into the ocean and allowing the current to act as mail man in delivering them is rather slow and uncertain, but it is better than no mail at all, inhabitants of the isle of St. Kilda, off the west coast of Scotland, have decided. It is one of the loneliest of British possessions and there is no post office and no means of obtaining stamps. The letters, therefore, are placed in a tin box containing necessary postage, the box is fastened to a wooden float marked "St. Kilda Mail. Please Open," and the package is cast upon the waters. Following the currents, the float usually is cast up among the Shetland islands, but the system is a slow one. The last mail took two months and twenty days to reach London and many letters never reach their destinations.

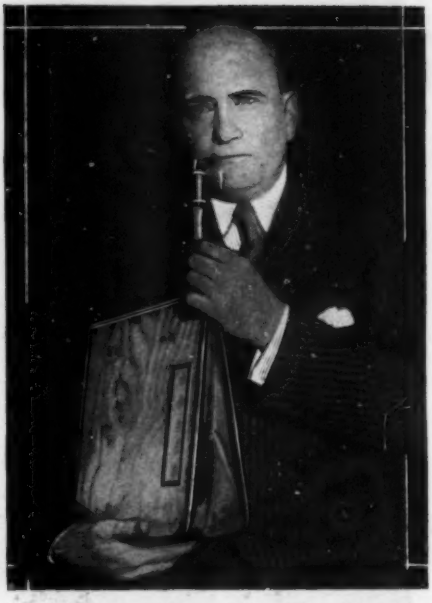
MOTOR-DRIVEN LAWN ROLLER EASIER TO HANDLE

Greater ease of operation is claimed for a motor-driven roller introduced in England. The engine is inside the roller, where it is protected from the weather and renders the implement exceptionally easy to handle. It may be operated in either direction. The unit is adaptable for light contractors' work and eight pints



All He Has to Do Is Guide It; the Motor Roller in Operation; It Runs in Either Direction

of fuel is said to be sufficient to keep it in operation for a whole day.



Artificial Lung and Larynx Which Talks When Lips Placed about Speaking Tube Form the Words

ARTIFICIAL LUNG AND LARYNX SPEAK AS LIPS FORM WORD

Carrying on a conversation by artificial means is made possible by an artificial lung and larynx which operate much as do the natural organs employed in speaking. It is possible to speak merely by forming words with the lips placed about the tube of the device.

CLOWNS HELP CLEAN UP CITY WITH PAINT AND BROOMS

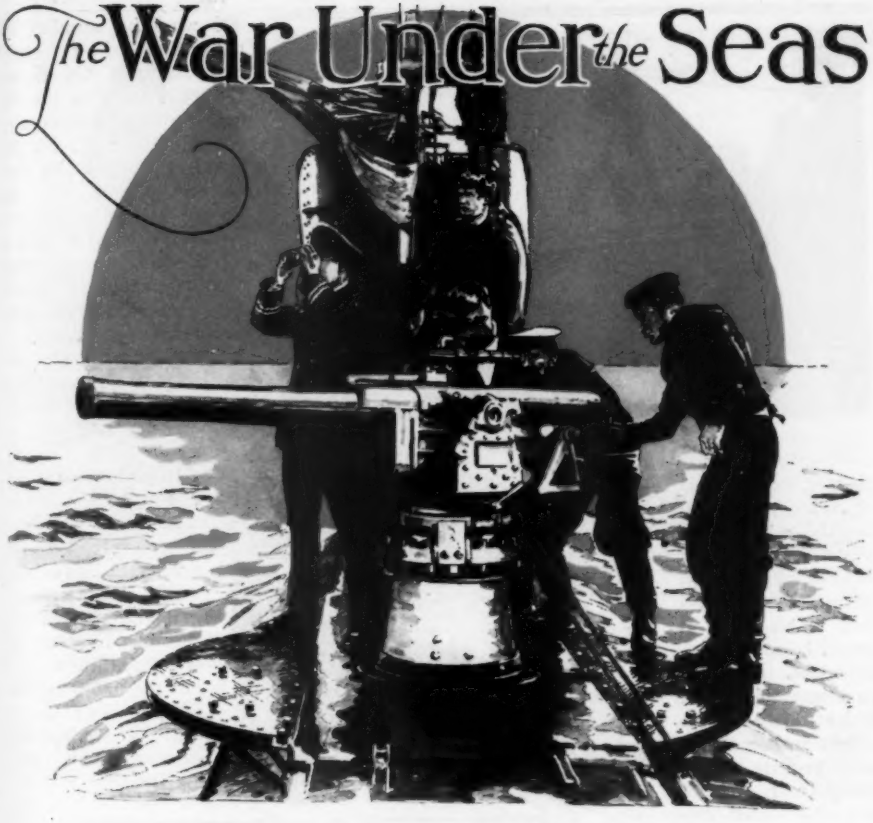
Two clowns, one a man and the other a woman, armed with paint brushes, rubbish and brooms, have been used to remind people of Montreal of clean-up week. The clowns, attired in startling costumes and carrying sandwich boards telling of the campaign, paraded the streets, the woman preceding the man and strewing cans and rubbish which the man swept up as his partner discarded it, after which he delivered a lecture to her on the need for cleanliness.

¶The first cable message to England cost $5 a word.

Painting of American Squadron by Burnell Poole. One of a Series Presented to the Naval Historical Foundation by the E. I. Dupont De Nemours Company and Loaned to the Naval Academy

Copyright, Naval Historical Foundation

The War Under the Seas



Painting of American Squadron by Burnell Poole, One of a Series Presented to the Naval Historical Foundation by the E. I. Dupont De Nemours Company and Loaned to the Naval Academy

By LOWELL THOMAS

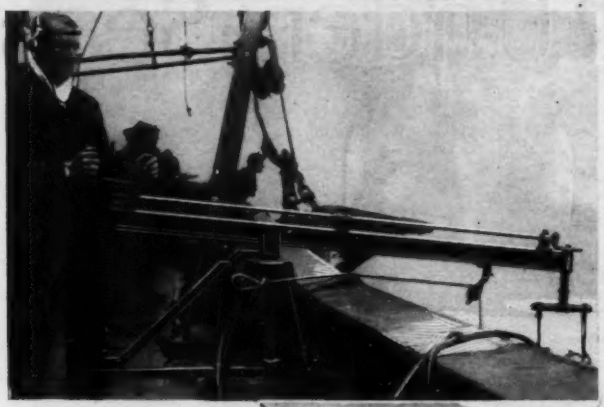
Author of "Raiders of the Deep," "Count Luckner, The Sea Devil," and "With Lawrence in Arabia," etc.

THE CLOAK of invisibility is one of mankind's ancient dreams. Its advantages in many situations of life are obvious—in a fight especially. Invisibility in warfare has been an endless preoccupation of frequently embattled humanity.

The World War, which brought the art of spilling blood to new heights of technique, provided new wonders of concealment. Two especial and opposing arts there were, as there have always been, the one for spying on the enemy, the other for hiding yourself from him. The former, essentially reconnaissance, found its principal modern invention in the aeroplane. Of the latter there were many sorts, camouflage, the smoke screen, and, above all, the submarine.

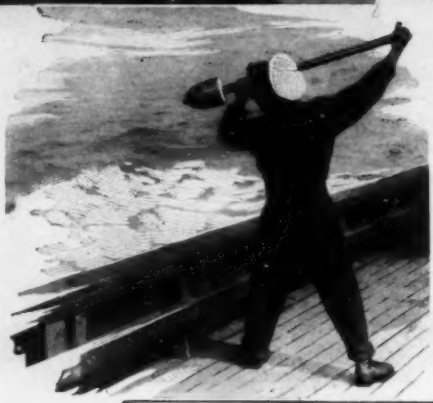
The swift development of submarine warfare was in no wise expected when the nations embarked upon war, and if you had wanted to do a bit of fantastic imagining, you might have drawn a picture of warfare between the boats that navigated beneath the surface of the sea, of the submarines of one nation campaigning against the submarines of the other. Even now, more than ten years since hostilities ceased, very few people have any clear idea that there was any organized combat of submersible craft against submersible craft, and yet it was one of the most striking features of the war, one of the most tense, and almost inhumanly dramatic.

Among the many measures that the al-



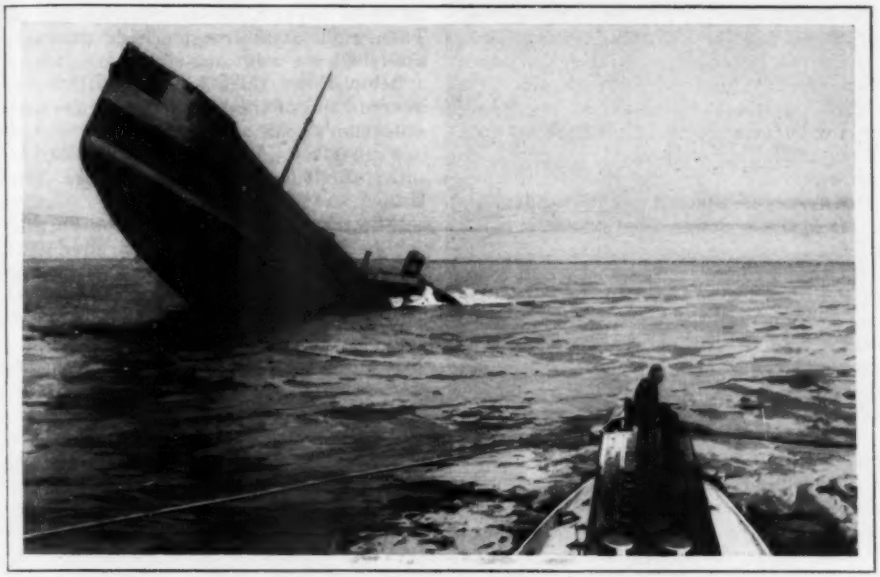
lied powers took to thwart the fearfully effective threat of the U-boats was the systematic use of submarines against them. You would not think that it could have any importance. Chance encounters between submarines you might expect as a very remote possibility, but surely not that such encounters would become a normal feature in the scheme of things, or that these fights would have any appreciable part in the decision of war at sea.

Nevertheless, allied submarines were sent out on regular patrols against the U-boats, haunting and stalking the lanes which German prowlers customarily followed. During the entire war the Germans had a few more than 300 U-boats in active fighting service. They had many more under construction and ready to be put out when the war ended, but about 300 was the number of those that did any actual campaigning. Of these, 178 were sunk by the allies, a ghastly percentage of losses. Mines took the heaviest toll of the under-sea raiders. But as we look over the list, we are amazed, and at first a bit baffled, to observe that seventeen U-boats were sunk by allied submarines.



Then, too, there were many fights between the under-sea boats in which neither side won a complete victory. Altogether, it makes a startling chapter with more than its share of sudden drama, incredibly swift climax, and grim horror. With this fact in mind, it is interesting to recall the naval axiom of pre-war days, that "a submarine cannot fight a submarine."

Hydrophone Being Operated from Submarine Chaser; Hurling a Lance Bomb, and German Sub at Full Speed



From a Photograph Found on Board a German U-Boat Captured by the British; Bow in the Air, the Unlucky Steamer Is About to Sink While the Sub Crew Watches

As usual, the prophets proved to be false prophets.

The first U-boat sunk by an allied submarine was the "U-10," lost in the summer of 1915. The British admiralty conceived a brilliant and cunning idea. They decided to send out one of their submarines to take part in a scheme to trap the enemy. It was at the time when the U-boats were at the peak of their ruthless campaign of destruction against British fishing craft. The subtle plan of the London sea lords was to use a fishing smack as a decoy and have it cruise around with a British submarine in tow. Of course the latter was to lurk just under the surface, with not even its periscope above water to give warning. It would be connected with the fishing smack by a telephone line. Then, if a U-boat on the prowl approached the innocent-looking fisherman and came along on the surface with the intention of sinking her by shell fire, the plan was for the British sub, apprised and guided by telephone, to pop suddenly to the upper zone and cut loose with a torpedo. Superb idea, and so in fact it came to pass.

On June 23, 1915, the trawler "Taranaki" could have been seen meandering along the Scottish coast, some sixty miles off Aberdeen. And who would have suspected that she had a haul of steel fish in view—with a steel fish of her own to effect the capture? For, attached to the towline of the harmless-looking "Taranaki" was the British under-sea ship of war, the "C-24."

"U-boat in sight!" called the lookout on the fishing smack.

It was the "U-40," headed straight for the trap and intent on sinking the seemingly inoffensive fishing craft.

But in another long cigar-shaped shell, leaning against the wall of his conning tower, with telephone receivers over his ears, was a gaunt young Englishman, Lieut. F. H Taylor of the submarine service.

"Submarine a thousand yards astern." The message came from the trawler on the surface.

"Slip the towline," the order was passed along from Lieutenant Taylor to his men

But something went wrong, and she could not free herself. Her commander telephoned to the trawler which loosened the towline at its end. The "C-24" now

had 300 fathoms of towline hanging from her bow. She immediately began to sink, bow first. It took time to bring her to an even keel. Then she came to periscope depth for a look. The U-boat was lying on the surface, ready to sink the trawler. The "C-24," running with her periscope showing and dragging that monstrous length of cable, steered to within 500 yards of the unsuspecting German. It took great seamanship to get in a shot.

"Torpedo, fire!" And the white wake of the torpedo sped true to the mark. A heavy explosion, and the "U-40" instantly sank. The British boat came to the surface and picked up two officers who had been on the deck of the U-boat—the only survivors.

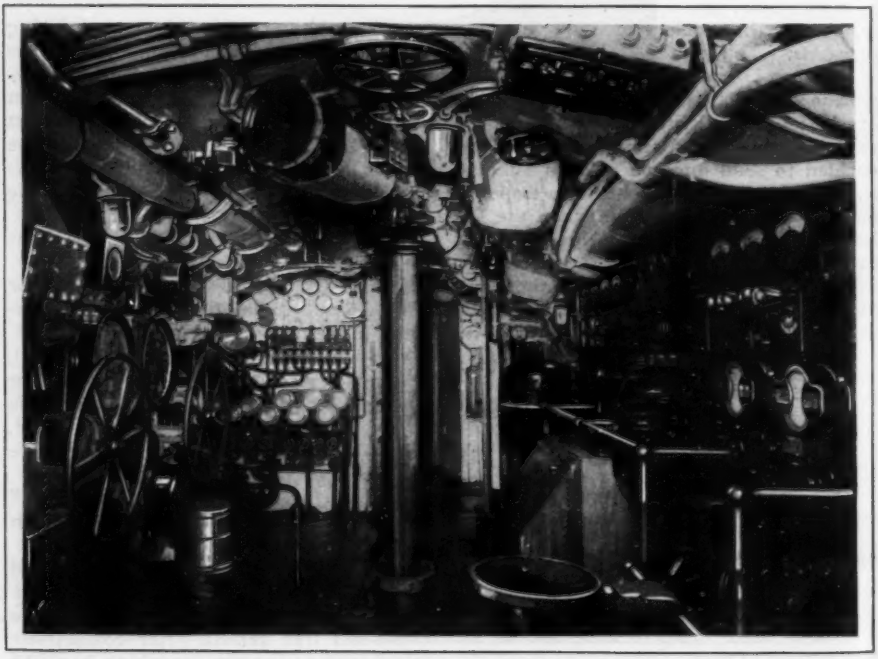
A month later the British "C-27" was being towed beneath the surface under similar circumstances. A U-boat appeared, and ordered the trawler to "abandon ship." This was reported to the "C-27," deep in the water below. The telephone wires were kept hot, while the stalkers waited for the U-boat to come up close enough for an effective attack. Then, right at the most critical moment, the telephone went out of commission.

Below the surface Lieutenant Dobson, in command of the "C-27," swore his best sailorman's oath at the luck. He waited in a quandary. Then he heard explosions above, shells bursting on the surface. The U-boat was firing on the trawler.

"Slip the towline," ordered Dobson, and the "C-27" came up for a look around with her periscope. The German was shelling the trawler, which was replying to the fire. The "C-27" maneuvered for a shot.

"Torpedo, fire!"

A tense wait in the submerged boat. Not a sound. The torpedo had missed. Surely their game would be up. How could the Germans have helped but see that telltale white wake? No. The ill-starred U-boat did not move. It kept on firing away at the trawler. The fishermen aboard the lumbering old craft were putting up as good a fight as they could. They were out-gunned, and German shells were raking them from bow to stern. In

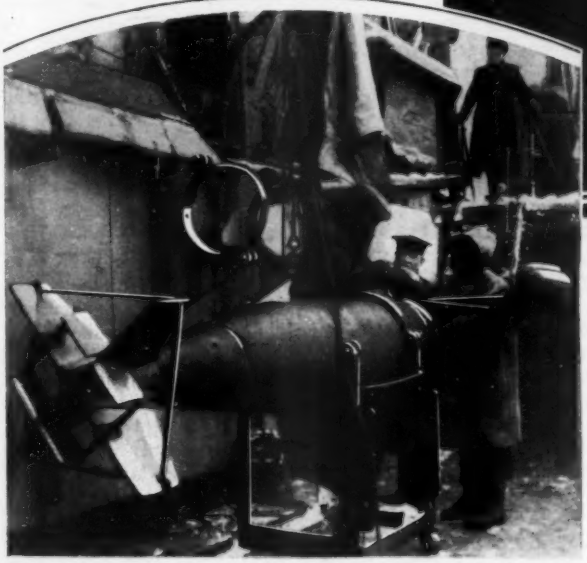


View inside the "S-4," Looking from the Aft End of the Control Room; the Complicated Chamber Corresponds Roughly to the Brain in a Human Being

the excitement of the fight and the thrill of seeing their missiles bursting on the enemy deck, the Germans were oblivious of everything else. They never noticed the white torpedo track that had swept past them.

"Ready for another shot," ordered Dobson, as he shifted his aim. This time the torpedo sped true. A heavy explosion and the "U-23" plunged to the bottom. The "C-27" blew her tanks, came to the surface, and picked up the captain of the U-boat, two officers and four men who were swimming in the sea.

These prisoners, through some stupid lack of foresight in England, were placed in a general prison camp, where they told and retold the story of how their craft had been sunk. Through prisoners' letters home, perhaps in code or invisible writing, the word got back to Germany. Of course any ambuscade to really function must be secret. U-boat commanders were warned of the trap of the trawler and the hidden submarine, and the British soon realized that their little game had been found out. Even then they continued the plan until August, 1915, when the "C-29," while being towed submerged off the mouth of the Humber, struck a German mine and was lost. That disaster brought about the final abandonment of the scheme. Late in the war, the stunt was tried again, successfully, too. The "UC-10" was sunk off the Moas lightship by Lieut. Robert Raikes, the only British submarine commander to sink two U-boats.



Close View of Paravane Used to Deflect Mines from the Sides of a Steamer; Upper View Shows Paravanes' Tracks beside Ship

But for the most part, after August, 1915, the strife between the submarine fleets was carried on straight, without trick or stratagem. Of course two submerged submarines could not fight each other effectively. Occasionally two submersibles on the surface would exchange shell or machine-gun fire, but no craft was ever sunk in this kind of encounter. Once or twice a submarine tried ramming an enemy of its own ilk, but that was a mere futile frivolity. The under-sea craft stalked and sunk each other with one single kind of

strategy. A submerged boat would steal upon and torpedo a boat running or lying on the surface.

A large part of a submarine's life is spent on the surface. Long runs, especially those very long voyages the German U-boats made, were nearly all on the surface, so far as mileage went. The submersible hid itself under the water only when attacking with torpedo or when evading attack. The British gradually closed the English Channel against the U-boats. They laid a series of effective barriers of bomb-studded nets, mines and patrol boats—the famous Dover patrol. That forced the U-boats raiding the Atlantic to take the long course northward through the North sea and around the tip of Scotland. This led through fairly narrow waters where the British submarines kept a patrol, running submerged and lying in wait for Germans on the prowl who happened to be on the surface. Then, too, in the Mediterranean, the U-boats were exceptionally busy and successful. Here they established bases along the Austrian coast. But the Adriatic happens to be a narrow sea, and provided an excellent hunting zone for allied submarines.

One day a German U-boat set out from Trieste. She was the "U-81," and was running submerged. The British "E-54," likewise submerged, was not far away. Two periscopes were ripping through the water, leaving their white wakes behind. One thing a periscope cannot see easily is another periscope. Each under-sea raider below the waves was totally unaware of the proximity of the other. The one that broke water and came to the surface in sight of the other was fairly certain to get winged by a torpedo.

Aboard the "U-81," the commander was Lieutenant Weisbach, an officer who had figured in memorable episodes. He was second officer of the "U-20," when that craft sank the "Lusitania" and set the world aghast. Then he became commander of the "U-19," and in that craft carried the ill-fated Roger Casement to Ireland for that succession of events which led to the hanging of Casement, the Easter rebellion in Dublin, Sinn Fein, and the drawn-out savage struggle between Ireland and England.

The periscopes were running on the sea. A merchant ship appeared on the horizon and shaped a course toward the periscopes. That was the break. As the vessel approached, the U-boat broke water, fired a shell, and gave the order to abandon ship. A wild tumbling into the lifeboats, and then the "U-81" began shelling the steamer to sink her. While she was firing away, she was being stalked by the "E-54." The white wakes of two torpedoes . . . both hit the German with terrible explosions. The "U-81" went down like a rock. Seven men were left swimming in the water. The "E-54" picked them up. Lieutenant Weisbach, commander of the U-boat, was wounded and drowning. A British officer jumped overboard and saved him. Meanwhile the lifeboats of the steamer were rowing away. The "E-54" wanted to help them and went after them. They rowed the harder. The encounter between the submarines had been so swift that the castaways did not realize what had occurred. They thought the submarine pursuing them was the U-boat and bent to the oars with renewed vigor, trying to escape. The "E-54" finally caught them, and it took a lot of explaining to make the frightened people understand what had happened.

But for war at sea with a particularly ghostly flavor just imagine, if you can, an encounter of submarine against submarine—at midnight! Craft lying so low on the surface might be expected to be perfectly protected by the shroud of night, but it happens that the only German U-boat the British sank in the Mediterranean was torpedoed near the witching hour of midnight.

"We were running on the surface near Durazzo," related Lieut. Comm. Oliver North, of the "H-4." "It was a bright night. The sea was calm. Eleven o'clock, and I was below having a bite to eat before turning in.

"'Submarine in sight,' came the call from the watch officer in the conning tower.

"I got up as fast as I could, and, sure enough, there was a conning tower about a thousand yards away on our port bow. It was a German in full silhouette before a bright moon. That moon was his doom. The helm was set for a half course around him. It was an eerie hunt in the moonlight. Soon we were a bare fifty yards off

Protecting a Harbor from Invasion by Submarines; Line of Nets at the Headquarters of the Grand Fleet in the Orkney Islands during the World War

his port beam—at point-blank range you might say. Then he must have sighted us, because he started to submerge. It was too late. We turned loose two torpedoes and both got him. That was the end of the 'UB-52.' We came to the surface. There were shouts from the dark water. We steered over and picked up two men, the captain and navigating officer of the foundering craft. They had been the only two in the conning tower when the torpedoes hit and were able to throw open the hatch and jump out before the boat sank. All the others went down in the iron shell, poor devils."

It happens that the commander of the "UB-52" was Lieutenant Lauenburg who had previously participated in a miraculous affair between two submarines. It was at the time when he was second officer under the famous Arnauld de la Perriere, the redoubtable U-boat ace of aces. The "U-35" was on its way back to its base port at Cattaro in the Adriatic. The commander was below. On deck keeping watch were two officers. One was Prince Sigismund, son of Prince Henry of Prussia and nephew of the kaiser. The other was this same Lauenburg. Suddenly they saw a periscope only forty yards to starboard and instantly the white streak of a torpedo The white streak darted swift and true. The two men stood petrified. There was no time to evade the deadly missile. Then the perfectly aimed torpedo leaped out of the water, as faulty torpedoes sometimes did. It described a graceful arc, like some giant flying fish, and landed on the U-boat's deck. Its war head did not strike, and it went sliding and clattering across, plunged into the water on the other side and then sped on its way. A moment later came another torpedo. The British, seeing that their first torpedo had jumped, set the second one lower, too low. It passed under the "U-35." Then two more torpedoes, but by now the "U-35" was swinging around. A submarine end-on is an almost impossible target. Both torpedoes missed. Then the "U-35" submerged and made safely away.

After a phenomenon like that, Lauen-

burg could scarcely be expected to find another in his path. In command of his own boat, the "UB-52," the British torpedoes hit, his boat sank under him and Lauenburg spent the rest of the war a prisoner in England.

(To Be Continued)

BANKED SHOTS OF BILLIARDS ARE MADE WITH MARBLES

Shooting Marbles on a Base Surrounded by a Rubber Rim Enables Banking the Agates as in Billiards

The thrills of marbles and billiards are combined in an indoor game played on a flat base. A rim of rubber around three sides of the base enables shots of marbles to be banked as in billiards. The end of the board nearest the player contains seven slots, those at each side representing penalties when the banked marbles fall into them and the five in the middle representing credits in various amounts. The sum deducted or added to a player's score doubles or trebles according to the number of banks made by the marbles off the rubber rim before dropping into the slots.

SHORTEST RADIO WAVE CURES FADING AND STATIC

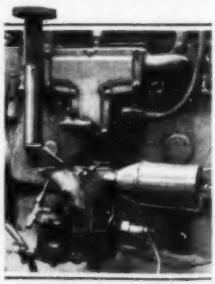
Static and fading, two disturbances to which ordinary radio wave bands and the short waves ranging from ten to 100 meters are subject, disappear entirely when wavelengths under three meters are used, reports of experiments with ultra-short waves before the German Radio-Technical association show. Experiments were conducted with waves ranging from three down to three-quarters of a meter and a method was found of producing an antenna effect of 300 watts with three-meter waves, the outfit spanning a distance of 250 miles in radiophone transmission. With an antenna effect of only one-tenth of a watt, phone transmission over 40 miles was possible, and in this case the sending set, no larger than a cigar box, worked even without an antenna. It is possible to calculate the range of the waves very closely, and they are not affected by the proximity of high-tension lines or electrical machinery.

ONE OUNCE OF POISON KILLS THREE HUNDRED RABBITS

Wholesale poisoning is being employed in agricultural sections of Nevada to get rid of jack rabbits which have become such pests that they have devoured entire haystacks. One ounce of poison, mixed with ten pounds of alfalfa leaves, accounted for more than 300 bunnies in one night, and one man working for a week succeeded in killing more than 1,000 rabbits by poisoning.

CARBURETOR USES FUEL OIL KEROSENE OR GASOLINE

A carburetor has been designed primarily to use fuel oil, but its inventor says that it also will operate with kerosene, gasoline or a mixture of any two or all three of these fuels. Saponified mixtures of fuel oil and water also have been used. No special manifold is required and no adjustment is necessary in changing fuel. The engine temperature, it is claimed, is no higher than when gasoline is used, carbon deposit is about the same as for gasoline, mileage is slightly higher, starting is facilitated and crankcase dilution is reduced. Increased power, particularly at low speed, and greater flexibility are other advantages claimed.



RADIO-DRIVEN PLANE LAUNCHED WITH ROCKETS

Inventor with Model of His Proposed Rocket and Radio Plane, Showing the Power House to Transmit Electrical Energy by Wireless; Rockets Would Aid in the Take-Off

Will airplanes and other craft be propelled by electric energy transmitted through the air? A western inventor believes that they will, and is experimenting with a model ship in which he combines the rocket idea of motor power w'th plans for driving a special electric motor by wireless. The rocket, he expects, will be chiefly of aid at the take-off and in acquiring additional speed in the air. Land stations would transmit the waves which would drive the plane's motors.

GOLD AND QUICKSILVER FOUND UNDER OLD MILL SITES

Abandoned mill sites, where thirty years ago amalgamation was the only process used to recover gold, with the result that quicksilver was washed out in the tailings, now are being worked and are yielding profits from mercury. Plants for recovering the mercury from the old mill tailings have been installed, and one of them on the Carson river in Nevada is taking gold, silver and quicksilver from the river bed. In some instances, the foundations of old mills have been moved, and the quicksilver followed to a depth of forty feet or more into the earth, as it has the faculty of working its way through apparently solid rock and taking its gold and silver content with it. At a mill site in Elko county, Nevada, a shaft sunk by men searching for a silver vein exposed quicksilver at a depth of 75 feet. The mercury had escaped from amalgamation pans used in the old mill and pools containing from fifty to 100 pounds of the metal were found to yield high values in both silver and gold.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

Thrills in the Life of a

"Smoky Joe" Martin, Famous Fire Fighter, Who Has Answered More Than Fifty Thousand Alarms in New York

FOR real adventure one need not go beyond the confines of one's own home town, according to "Smoky Joe" Martin, assistant chief of the New York fire department for forty-five years, who has answered the call of over 50,000 alarms.

In the everyday experience of the fireman, says Smoky Joe, a man can find the essence of the super-thrills encountered by soldiers of fortune in remote regions of the earth.

Narrow escapes from death, daring rescues in the face of destruction, dock fires, subway fires, skyscraper fires, tenement fires, explosions on land and water—all of these have figured in the career of Smoky Joe. He is sixty-five today and still his rakish red roadster is parked outside of his home in readiness for his response to fire alarms.

Although he has participated in the fighting of more than 50,000 blazes since 1884, he still recalls his first fire. "I had reported to the engine house for work at eight in the morning," he said. "Firemen in New York had longer and earlier hours then. I was nervous all day, wondering what the first alarm would bring. Nightfall arrived, and still our engine house in the downtown district received no call.

"At 9:00 o'clock that night," he continued, "the bell clanged. My first fire was in the lower Broadway section. Out we rolled, headed as fast as the horses could go.

"Those were days when horses were in use. The old horses could travel too. The fire was at a sweatshop. When we got there, the flames were shooting out of the windows and the smoke was drifting down the street like a pall. There is no way of describing all the sensations that shot through my mind as I approached the scene of my first fire. I was as nervous as a steeplejack who has lost his grip.

"I was on a line hose at that job. We went to work and had the fire under control in pretty short order. But that scene showed me all the color and excitement of the fireman's life. The boys were battering at the door of the building with axes and running up ladders from the street, going right into the blazing building while our hose played all over the place.

"The worst fire I ever fought," he went on to say—"and I have come up against a lot of wicked ones—was the big oil fire in Greenpoint, Long Island City, a part of Greater New York, in September, 1919. It was as hard a proposition as ever confronted the New York fire department.

"We fought that one for four days, before it was under control. Every hour was sixty minutes full of danger for the men. Twenty-nine tanks were ablaze and

Fighting a Five-Alarm Fire on Bleecker Street, in New York; "Smoky Joe" Stands beside the Movie Cameraman, Watching His Men Pour Tons of Water into the Flames

all around them stood others that might take fire at any time. There were gasoline tanks in there, too, holding 75,000 gallons to the tank. If those had gone up, it would have been the worst conflagration in the history of New York.

"These explosions would have rained death and destruction out of the skies over the whole danger area. That was a fire with thrills in it galore. There were roaring masses of flame, clouds of billowing smoke obscuring the sky. Through it all, hundreds of raincoated, helmeted men battled heroically against the progress of the blaze.

"Five fireboats ran up a creek which crossed the fire area, while, on land, fifty fire-fighting companies with full apparatus were working doggedly to bring the fire down.

"That was the only time a second fourth alarm has been turned in for the same fire. That record-breaking signal came when the fire suddenly jumped the creek and it looked as though the flames were going to win out. All leaves in the department were stopped while the fire was on and every available man was rushed to the scene.

"The foamite plant, built to combat just such a blaze in the tank yards, burst from the heat an hour after the fire started, and this arrangement for covering the surface of the burning oil with a protective coating and thus stifling the flames was lost to us.

"Right in the middle of things—about the third day—a young chap came to me with the nerviest proposition I ever received at a fire. He was an aviator. He offered to fly over the blazing tanks and drop a load of extinguisher into them. I turned him down. It would have been certain death to let him get anywhere near one of those tanks in a plane. In the future, however, airplanes may be utilized to a great extent in fighting fires.

"It was so hot at this fire that I saw a solid brick wall actually melting. The bricks were so soft they were dripping.

Fighting Skyscraper Fires Is a Science in Itself; Roofs of Adjoining Buildings Are Often Used as Vantage Points

It was one of the closest approaches to an inferno on earth that I ever witnessed. Still it was not beyond human conquest."

Firemen are brave lads, seldom conscious of their duty, he explained. "Yet the fireman is human," he continued, "and he has all the emotions, of course, that other mortals undergo, such as fear. There is one fire above all that puts fear into a fireman. That's the one where there is the life hazard.

"It is a terrible thing to know when you are rushing to a fire that lives are hanging in the balance. There is always the horrible doubt lurking that you may get there too late. The boys are mad with haste whenever they get an alarm that tells them of a building ablaze with people in it.

"They fear for the folk in the building every jump of the way. Take a big tenement in a congested district, with a number of families living on each floor. A fire there, with the lives of women and children at stake, and you have a serious crisis. Firemen have distinguished themselves gloriously in combating these tenement fires. Every year hundreds upon hundreds of lives are saved in these particular blazes."

The old Equitable building fire and the Delancey street bridge blaze—both outstanding in the history of New York—were fought by Smoky Joe. At the Delancey street bridge fire he scored a great life and property-saving coup when he stopped river traffic.

The cables of the bridge, which overhang the river, made of innumerable strands of heavy wire, were a potent source of danger. If any one of them had fallen onto a boat, he pointed out, the vessel would have been cut in half.

As for the origin of Chief Martin's sobriquet, he has been called Smoky Joe for twenty-five years. It all started at a tough fire in the downtown market section, near the Hudson river. The fire fighters were collapsing all over the pavement, overcome by smoke. But the smoke fumes could not keep Joseph B. Martin off the job. He seemed to thrive on the smoke. From that day onward Fire Chief Edward Croker called him Smoky Joe.

Since the first day he entered the fire-

Seattle's Newest Fireboat Testing Its Nozzles and Pumps at the Rate of Twelve Thousand Gallons a Minute; Fireboats Play a Prominent Part in Fighting Waterfront Blazes

fighting profession, Smoky Joe has been greatly interested in its development. "My first month as a smoke eater," he said, "I got $66 pay. I got three days off a month with no time off in between. The firemen of those days were up against it in the way of facilities. For instance, if you wanted an extension ladder in a hurry, it had to be hauled off a truck by hand and lifted into position. An extension ladder isn't a light bit of wood. Nowadays all the fireman has to do is to pull a lever and up she runs as high as you want her to go.

"Neither did we have the high-pressure system to help us. Today the pressure at the hydrant with its four outlets is equivalent to the power from four first-size fire engines. The big buildings help a great deal in present fire-fighting methods.

"The skyscrapers are fireproof, and most of them have put in their own standpipe lines, have a water tank on the roof and a line of hose on every floor. They have organized staffs so that they really have little fire companies of their own.

"On April 12, 1927, we had a freak fire on the forty-seventh floor of a hotel, 400 feet from the street level. Scaffolding in the tower under construction had burst into flames about eight in the evening. This one proved a stickler for me, I must admit.

"The hotel was under construction, so its own fire-fighting apparatus was not ready for service. Our own water lines could not touch the flames, though we tried shooting water from another hotel close by. The water ran short of the distance. The result was that the scaffolding, which shot off a shower of flaming brands, burned itself out. This would have been prevented if the installation of the standpipe had been completed.

"We feel no great fears over skyscraper or high hotel fires. Standpipes and fire pumps, hose lines, and first-aid extinguishers, supplemented by the watchman

Water Towers, with High-Pressure Nozzles Controlled from the Ground, Enable Firemen to Reach Upper Stories with Ease

service in these edifices, are sufficient to reduce the fire danger to almost nil. Such construction fires are very rare.

"As an example of the efficiency in subduing skyscraper fires under the present system, take the fire which broke out on the fifty-seventh floor of the Woolworth building last January. It was the highest fire in the history of New York. When this fire broke out, because of a short circuit, six people were marooned in the fifty-eighth floor tower.

"A hook-and-ladder company rolled up, and the firemen realized the futility of reaching the flames 765 feet above the street. Other firemen mounted to the forty-seventh floor in two elevators.

"From this floor they dragged their hose up ten more flights, where they attached them to the standpipe beside the elevator, then made short work of the flames. I am convinced that any fire at a great height could be extinguished in a similar manner with equal speed anywhere in New York.

"When fires break out on the docks or on vessels near New York City, the marine fire division is called into play as well as the land engines. We have organized an efficient department of fireboats. The latter have performed remarkable service in recent years. Subway fires, though rare, tax the fireman's ingenuity. Gas masks prove most useful in stemming blazes in these underground tunnels. Smoke is usually the greatest extent of these subterranean blazes."

Smoky Joe has missed death on about five occasions. Several times buildings have collapsed, catching him in a heap of debris. He has been a frequent inmate of hospitals, having broken at least a dozen bones and nearly suffocated on numerous occasions. His life has been replete with acts of valor, for which he has been awarded a number of medals.

POCKET FLASH IN THREE COLORS AIDS IN SIGNALING

Red, green or white light is projected from a pocket flashlight, designed for railway men, policemen, autoists, and others. A simple contact mechanism affords instant changes in color. The lamp is carried by a leather strap attached to a button or the belt.

ALGERIANS TO FIGHT LOCUSTS WITH POISON AND FIRE

This is a locust year in north Africa and an army of 60,000 Algerians is waging a campaign with poison and fire over more than 200,000 acres in an effort to kill the insects by tons. Two methods are employed. In some cases beaters drive the pests against great sheets which hold from 100 to 200 pounds at a time. In other cases they are driven into inclosures of corrugated iron, each capable of holding half a ton of locusts. They then are exterminated either with a spray of sodium arsenate or by flame throwers such as were used during the war. Poisoned molasses is spread over the territory after it has been covered. The whole campaign has been calculated mathematically and one table shows that, on the average, 120 locusts weigh one ounce. The cost is expected to be nearly $500,000.

FLIGHT FROM LONDON TO INDIA SETS NON-STOP RECORD

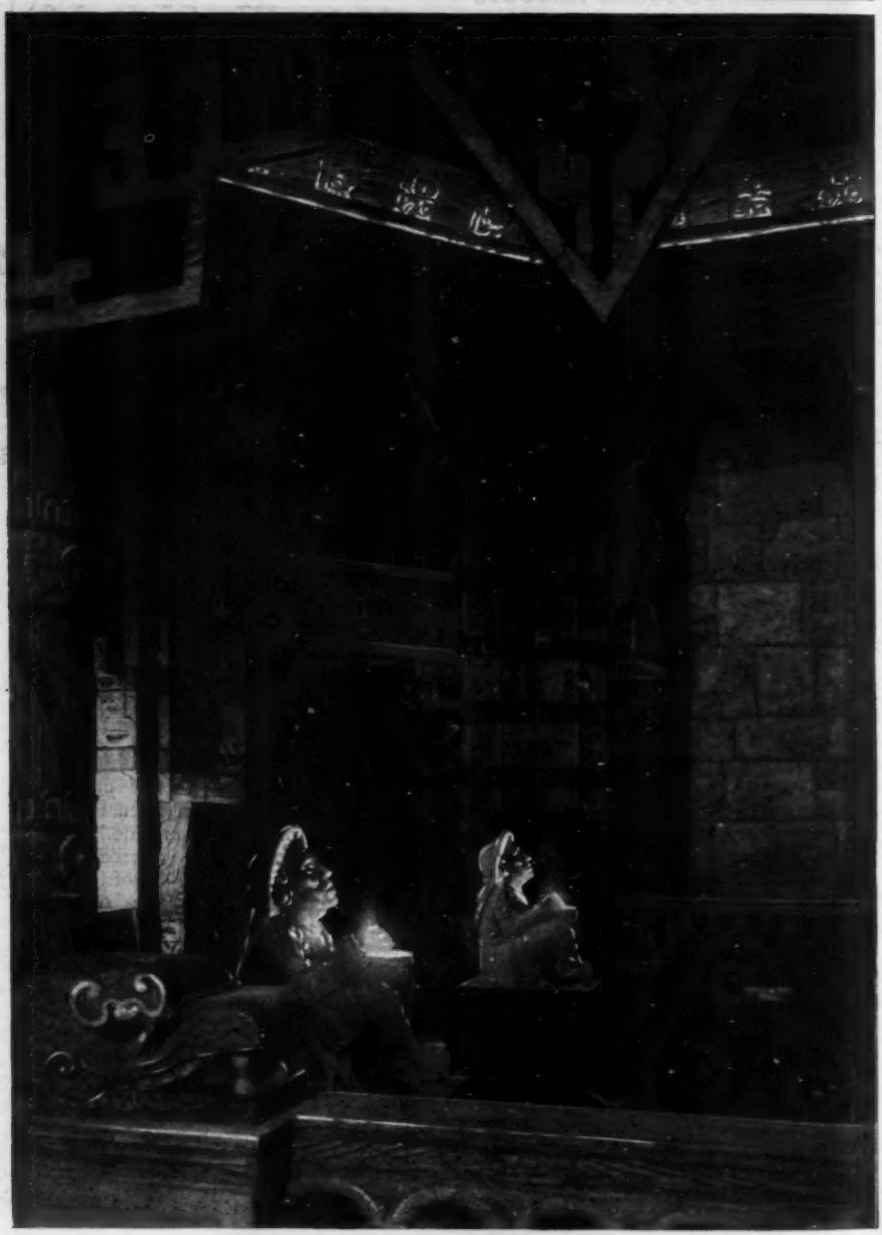
A record for non-stop flights by British airmen was established recently when Arthur G. Jones-Williams and Flight Lieut. N. H. Jenkins flew from London to Karachi, India, in fifty hours and forty-eight minutes. Their big monoplane traveled a distance of 4,130 miles and was forced down only by a fuel shortage, caused by the unexpected demands of unfavorable winds. The aviators had hoped to reach Bangalore and shatter all previous long-distance and non-stop records. The Italian flyers, Capt. Arthuro Ferrarin and Major Delprette, hold the world's non-stop flight mark at this writing, by their hop from Italy to Brazil, a distance of 5,062 miles in fifty-eight hours and thirty-seven minutes.

Sticky Screen atop Boston Tower Catches Moths to Determine How High They Fly

STICKY TRAP ON LOFTY TOWER SHOWS HEIGHT MOTHS FLY

Moths are recording their altitude records for the aid of science on sticky screens atop the 500-foot customhouse tower in Boston. To determine how high they are able to fly, copper screen frames were erected on the four sides of the tower and covered with a sticky substance. Moths flying against the screens are caught. Flies, persons studying insects claim, rarely ascend beyond the third story, if forced to come up from outside, but go much higher on the inside.

Monoplane in Which Arthur G. Jones-Williams and Lieut. N. H. Jenkins Flew a Distance of 4,130 Miles in a Non-Stop Trip from London to Karachi, India



A Glimpse of Ancient Mayan Splendor in a Modern Skyscraper; Detail of the Fisher Theater in the Fisher Building, Detroit; Changing Hues of Lights Produce an Element of Mystery

Going Up

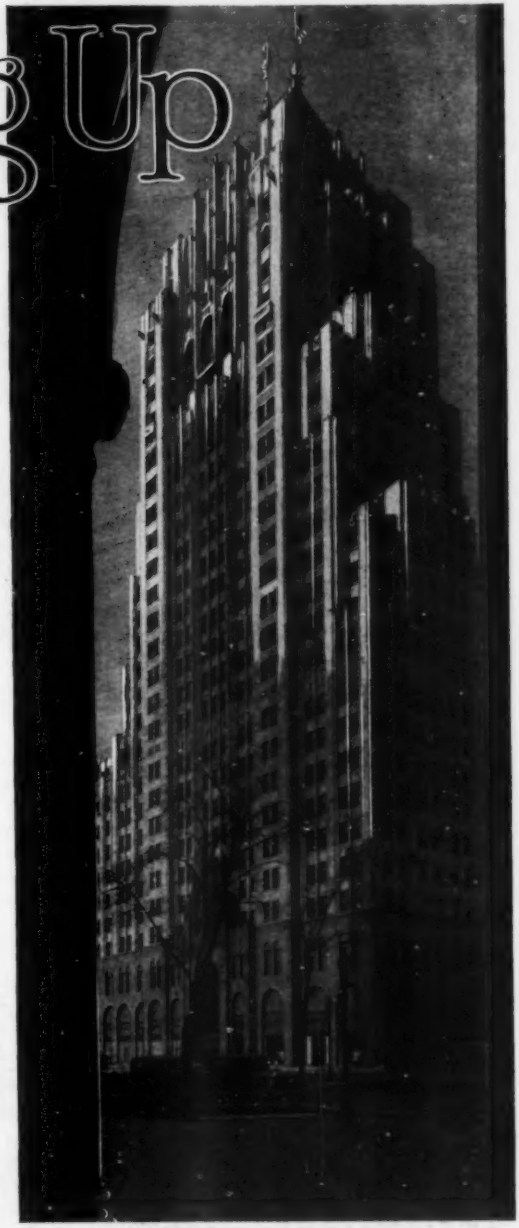
HE WAS showing his cousin the wonders of a big city. They were in an elevator of a skyscraper. Going up! Fifty stories, 680 feet, a swift and silent journey. Then down. They reached the street.

"Gee!" exclaimed the cousin; "we must have come down about sixty miles an hour!"

"Sixty miles coming down," said the city man "Say, those elevators make more than that when they're climbing up."

All of which goes to show that many persons have at least one mistaken impression about passenger elevators. Few travel more than 800 feet per minute, a mere trifle over nine miles an hour, so that, if the Woolworth building in New York were placed horizontally, the average man could run from one end of it to the other more rapidly than its speediest elevator could travel from the top to the bottom.

And, stranger still, the average person might believe he was traveling sixty miles an hour downward, while, in reality, he would be going nine miles per hour upward. Many applicants for the flying corps during the war know this. Blindfolded and placed in an elevator which traveled haphazardly up and down, many were unable to tell in which direction they were going. There is less of the shock and gasping effect in riding in the modern elevator, owing to the ease with which the cars are started and stopped. Recent installations have inner doors that completely hide the passing floors so that the passengers can-



The Granite-and-Marble Tower of the Fisher Building as It Appears from the General Motors Building, to Which It Is Connected by a Subway for the Convenience of Tenants

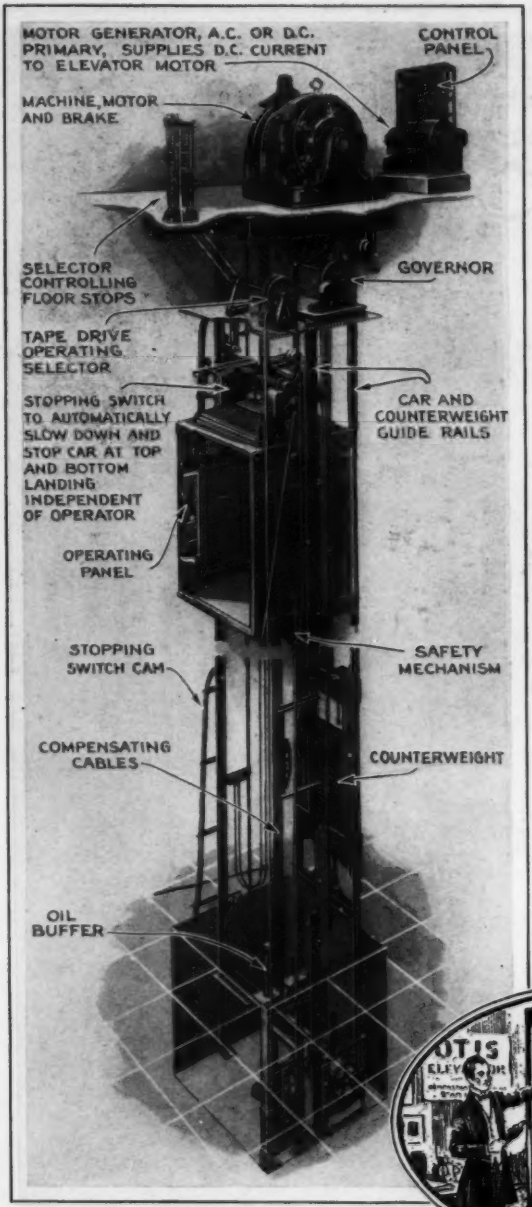

MOTOR GENERATOR, A.C. OR D.C. PRIMARY, SUPPLIES D.C. CURRENT TO ELEVATOR MOTOR
CONTROL PANEL
MACHINE, MOTOR AND BRAKE
SELECTOR CONTROLLING FLOOR STOPS
GOVERNOR
TAPE DRIVE OPERATING SELECTOR
STOPPING SWITCH TO AUTOMATICALLY SLOW DOWN AND STOP CAR AT TOP AND BOTTOM LANDING INDEPENDENT OF OPERATOR
CAR AND COUNTERWEIGHT GUIDE RAILS
OPERATING PANEL
STOPPING SWITCH CAM
SAFETY MECHANISM
COMPENSATING CABLES
COUNTERWEIGHT
OIL BUFFER

Diagram of a Modern Otis-Elevator Installation and Drawing of an Early Demonstration Scene; Probably More Than Any Other Single Factor, the Elevator Has Made the Modern Skyscraper Possible; Vertical Traffic in Big Buildings Involves Many of the Problems of Complicated Transportation Systems, with Time Schedules, Routings and Traffic Operators

not see the levels whizz by. This results in less dizziness.

Early elevators were clumsy affairs, operated in some cases by steam, by hydraulic systems or even by hand. With the dawn of the electrical age, the elevator became swift, silent and safe. It stops itself, levels itself at the proper floor, goes where it is directed simply at the press of a button and its doors open automatically. Should all the supporting cables break, an almost impossible accident, the car would fall for a distance of a few feet and then would grip the side rails along which the car slides, fasten upon the rails with such tenacity that a force of mechanics must be called to pry them off. The same dogs operate when the car gets out of control or when it travels too quickly upward or downward.

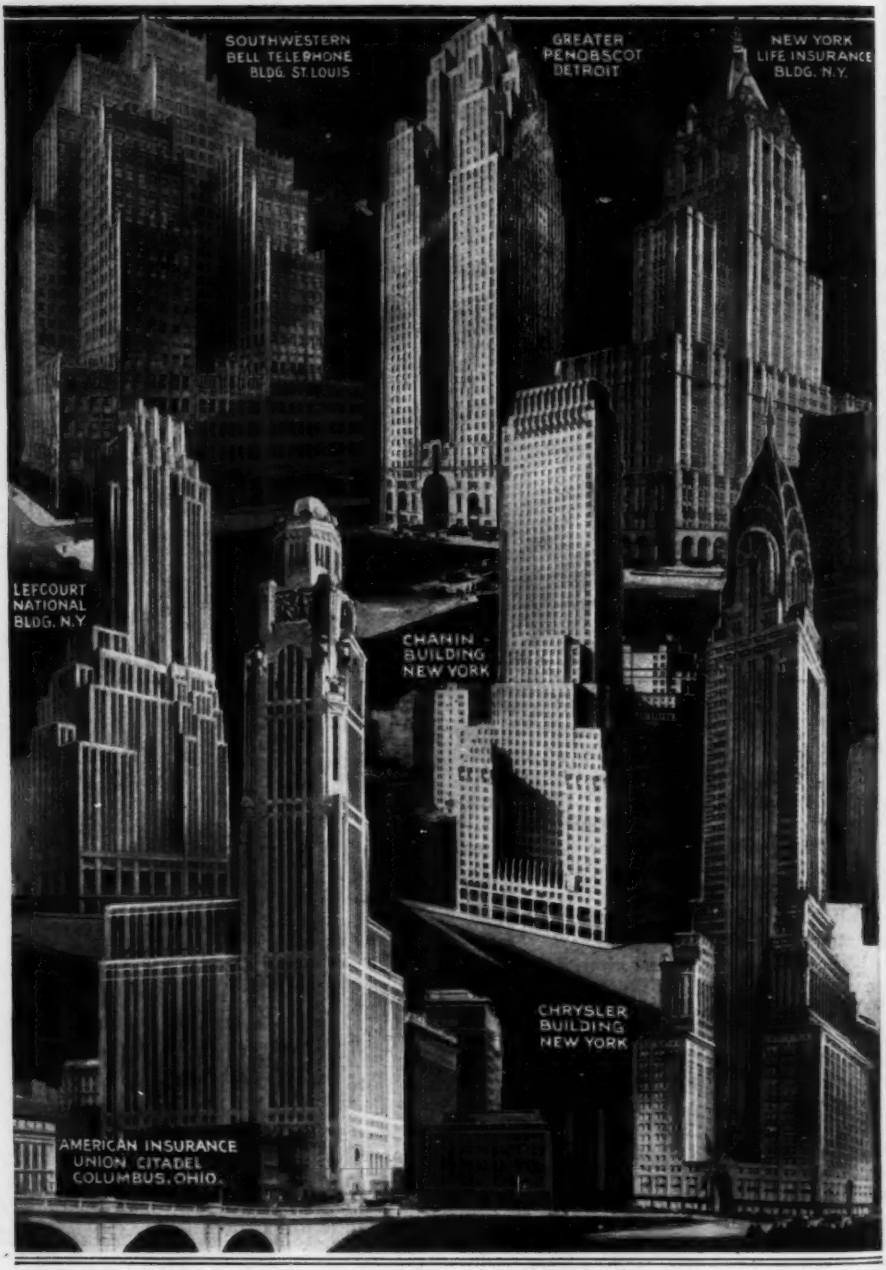
Imagine a city of 10,000 inhabitants. Take the houses and other buildings and pile them into layers until you have a heap twenty strata thick and half a block wide, perhaps. Now knock away the intervening walls and make passages so that the occupants can come and go freely. The task of the elevators in such a pile would be to fill the heap with people and empty it of them several times a day. That, roughly, is the feat that elevators perform in some of the

Automobiles Have Produced New Housing and Traffic Problems, with the Result That Garages Are Going Down as Well as Up to Find More Space; the Drawing Shows a Paris Traffic Plan

big skyscrapers of today. To meet the situation, the development has been constantly toward greater speed. Plans have been considered for operating two elevators in the same shaft or for having double-decked cars that would serve two floors at one time, but practically the same result has already been attained through greater speed.

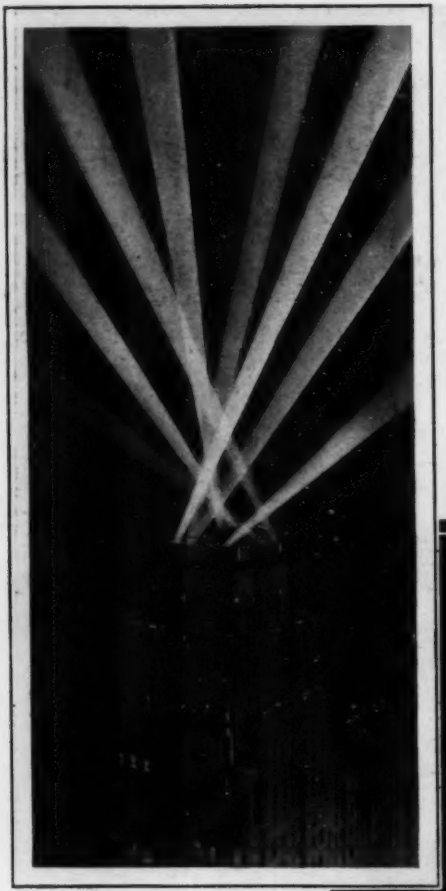
Take one of the fastest elevators of ten years ago. Electrically driven, it made 500 feet per minute. In a forty-story building, it could run a round trip in some 300 seconds, allowing time for several stops. Today, a twelve-passenger elevator, automatically controlled, can travel 1,000 feet a minute. It would complete the round trip in 150 seconds, and four such elevators would do what eight of the earlier type did. Equipment has been made for running elevators at a speed of 1,200 feet a minute, and even faster apparatus is possible. How high can the elevators run? As high as there is room left for the car and the necessary equipment, say the engineers. Literally, the sky is the limit as to the building height of the future, but, obviously, no one is going to erect costly structures just to see how high they can be built. The balancing influence of returns on the investment will gauge the height of the skyscraper of the future. Then there is another factor, not usually considered. It is the human stomach. If skyscrapers keep on soaring, elevators of higher speed will be necessary. To utilize this speed most efficiently, it will be necessary to make more abrupt stops, and the human organism is not adjusted to such treatment. The stomach rebels. The human factor of the operator has been met largely with automatic controls. Elevators that run faster than 600 feet a minute are now being governed automatically because a human operator cannot function as dependably.

Riding the Woolworth building elevators has been about the world's most generous offering in vertical transportation, but towers that will eclipse this fa-


SOUTHWESTERN BELL TELEPHONE BLDG. ST. LOUIS
GREATER PENOBSCOT DETROIT
NEW YORK LIFE INSURANCE BLDG. N.Y.
LEFCOURT NATIONAL BLDG. N.Y.
CHANIN BUILDING NEW YORK
CHRYSLER BUILDING NEW YORK
AMERICAN INSURANCE UNION CITADEL COLUMBUS, OHIO.

Typical Examples of Modern American Skyscrapers, Showing the Tendency toward Towers, a Natural Result of the Step-Back Regulations Required to Prevent Shutting Off Light and Air

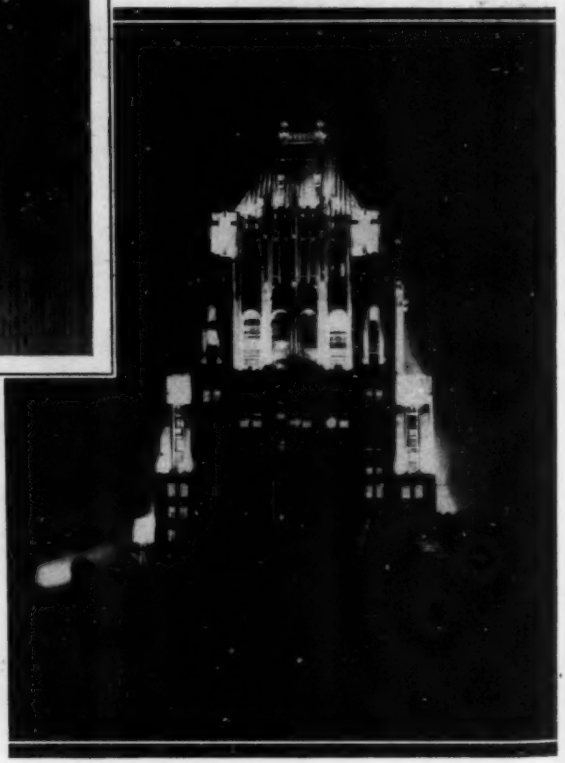
One of the First Skyscrapers in the World, the Tacoma Building, Has Been Razed in Chicago to Make Way for a Larger and Taller Structure, Pointing to the Fact That a Skyscraper's Life Is Less Than Forty Years



mous structure are rising or are planned. The Chrysler building in New York, for instance, will be 809 feet high. The Bank of Manhattan, 840 feet, and the Crane Tower, proposed for Chicago, is to be 182 feet higher still. The modern trend in skyscraper construction is toward the tower, a natural development from the step-back plan that admits light and air to the street below and to buildings near by.

In the last few years, architects and engineers have developed the skyscraper to a degree of beauty not at first believed possible when the main idea was simply for utility. What is considered one of the finest examples of this late trend is found in the Fisher building in Detroit. Situated in the geographical heart of the city, it is built almost entirely of granite, marble and solid bronze. It is truly a city under a roof, for it contains a 3,000-seat theater; a bank; a 1,100-car garage, so arranged that many of the tenants can drive on a ramp of continuous elevation to the floor level of their own offices; public lunch and dining rooms; barber shops, and play rooms with quartz-glass windows for children; an entire wing devoted exclusively to the offices of doctors and dentists; shops, and exclusive club rooms, besides the many offices for business purposes.

The high-arched arcade, walled with



Effects of the Aurora Borealis Are Reproduced in Revolving Colored Searchlights on the Union Trust Company Building, Detroit, and a Detail of the Fisher Building Illumination

Interior Views of the Union Trust Company Building at Detroit, Where Novel Use Has Been Made of Color and Metals in the Decorative Schemes

over forty different kinds of marble, is a special feature of the building.

Detroit also boasts the new Union Trust building, unique because of the successful application of modern ideas in decoration and design. Extensive use has been made of metal as a decorative material. Elevator doors, counter screens, check desks and other details of the magnificent banking room are of monel metal. This building is not one of the country's largest or tallest, but its foundations go down 120 feet to bedrock and it is 535 feet tall.

When the $15,000,000 Chrysler building is completed, architects estimate that 11,000 persons can be comfortably housed in its offices. About 900,000 square feet of floor space will have to be swept and scrubbed daily. Cleaners will have to wash 3,750 windows, and 150 persons will be required to manage the traffic inside this city built into the sky. The elevators will have a speed of 900 feet per minute, although their actual operation will probably be slower, owing to the limitations of the New York building code. Preliminary announcements of the Bank of Manhattan state that it is to cost $20,000,000 and will be sixty-four stories high, forty-four feet taller than the Woolworth building.

Engineers already have made the estimates for the elevators to serve these huge new buildings. The problem, of course, is to provide adequate transportation for every floor, and the chief question the elevator men want answered before their work starts is, how many entrances will your building have? Knowing the height, area and other factors, they can judge the elevator requirements when they know how many people can get into the building.

As on other transportation lines, careful record is kept of the daily performance of many elevator installations. In a busy building, thirty to fifty miles per elevator per day is not unusual, where there are twenty or more stories to serve. One of the largest elevator installations in the country is in the Equitable building in New York City. It has sixty-three cars. They run about 227,000 miles per year.

Treating the Soil with Electricity as It Is Plowed; Current Distributor Is Mounted on the Plow

WIRELESS PLOW KILLS BUGS AND ENRICHES SOIL

Treating the soil with 160,000 volts of electricity as it is plowed, is one of the interesting experiments being conducted on an Illinois farm,where extensive research is under way as to the best applications of electricity in agriculture. A specially equipped plow is employed and is hauled by a tractor. High-tension electricity passes into the soil from the plowshares, and is said to kill weeds, various forms of insect life and, at the same time, have a beneficial effect upon the soil. Two large balls, which serve the same purpose as a wireless aerial, are carried upon a frame on the plow. Current is supplied from a transformer fed by a dynamo driven by a wheel belt, and an operator sits in front of a switchboard to regulate the flow of current. Sparks leap from the aerial balls to other metal knobs on the plow beams, a gap of about three-fourths of an inch. The current then passes through the right and left plowshares to the soil, and to a central blade which is designed to furnish a contact for the return of the induced current after it leaves the shares and enters the ground. The plow is usually run north and south through the field in the general direction of the magnetic lines of the earth. According to the inventor, the electrical treatment will give virtually the same effects as applications of various kinds of fertilizer.

SINGLE-LEG TABLE FOR CARDS FITS BESIDE CHAIR

Set up in a moment, a lightweight table can be adjusted for height without getting out of the chair. It has but one leg and is especially adapted for playing solitaire and for reading, or, if desired, it may also, on occasion, be used for serving meals to invalids.

NATURAL EXPRESSION IS AIDED BY MIRROR PHOTOGRAPHY

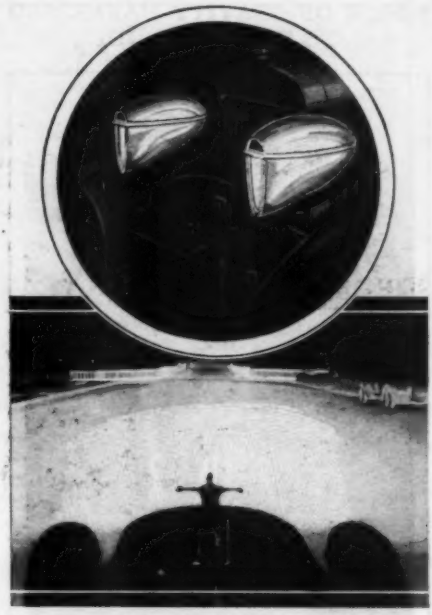
To achieve the natural expression so much sought by persons being photographed, a Yale professor has devised a system of mirror photography. The subject sits looking at a mirror and when he has the expression he likes best, presses a button in the terminal of a cord held in

his hand, and the picture is taken. The camera, concealed completely, works through a series of reflections to take the photograph as if it had been pointing directly from within the mirror. The art lies in replacing the ordinary feeling of artificial stiffness with something fascinating to do which makes a natural expression easy. Science, rather than art, however, is behind the experiments in mirror photography, as the object is to enable psychologists to obtain natural photographs of facial expressions.

RUBBER STRING RETURNS BALL TO THE THROWER

Boys who enjoy tossing a ball but dislike retrieving it have their problem solved in the captive baseball enabling them to engage in a one-man game of pitch and catch. The baseball, attached to a strong rubber cord, one end of which is fastened to a stake, returns with the same force with which it was thrown and the rubber cord allows a stretch of from eighteen to twenty feet. Pitched from the right of the stake, the ball returns to the left, requiring agility in catching, while a beeline throw returns as a grounder.

Elastic Cord Attached to Baseball Makes It Rebound to the Thrower



Close View of the Lamps, Showing Peculiar Shape, and Photograph Depicting Wide Spread of Beams

AUTO LIGHT WITHOUT GLARE SPREADS WIDE BEAM

Of unusual design and reported greater efficiency, an automobile headlight now on the market spreads a wide, flat-topped beam that illuminates the sides of the road. Its inventor has worked out a different shape of light, adjustment of bulb and other features that are said to afford a beam spread of 160 degrees but the rays are confined to a level that does not interfere with the oncoming motorists.

SPEED OF THE FASTEST BIRDS HUNDRED MILES AN HOUR

Swallows fly at the rate of more than 100 miles an hour and are among the world's fastest birds. The puma is reputed to be one of the swiftest wild animals and whippets hold most of the speed records among domesticated animals. Race horses often attain a speed of well over 1,000 yards a minute, while pigeons have been timed at speeds of nearly 2,800 yards a minute over a long course, and a mile a minute for short spurts.

FORCE OF GRAVITY HARNESSED TO HELP FIND OIL

The Gravitometer Finds Oil Deposits by Utilizing Force of Gravity Measured by Its Delicate Instruments

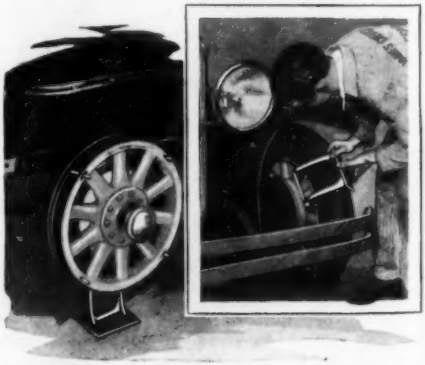
A device to locate certain types of oil deposits by utilizing the force of gravity has been introduced in Texas oil fields and is known as the "gravitometer." The instrument consists of a light-proof case in which is mounted a radiometer, a small device consisting of a paddle wheel of light disks blackened on one side and pivoted in a vacuum in such manner that the paddle wheel will revolve when struck by a ray of light. Controlled by a battery and also contained in the light-proof case, is a small electric bulb, so arranged that it throws a single ray of light of unvarying intensity on the disks of the paddle wheel, so that, at a given location, the paddles revolve at constant speed. Variations in the force of gravity at different points make a slight difference in the amount of friction in the extremely delicate bearings of the radiometer, thus causing the paddle wheel to revolve at varying speeds which are checked by the operator who peers through a periscope with a stop-watch arrangement to count the revolutions in a certain time. By marking on a map each point at which a reading is taken, a prospective area can be contoured by joining with a line the points showing the same number of revolutions.

NEW STAMP HONORS EDISON WITH LAMP DESIGN

Picturing Edison's first electric lamp on a postage stamp, marks one of the few instances in which inventions have been so honored. In commemoration of the twenty-fifth anniversary of the first flight, a picture of the Wright brothers' first airplane was used as a stamp design, and there have been pictures of steamboats, bicycles and railway trains on postage stamps, but they won their places because they were means of transportation and not because they were inventions. Edison's portrait could not be placed on a stamp because of the general rule that forbids the portrayal of any living person on money, stamps or other security of the nation. Few scientists have been commemorated by portraiture on stamps.

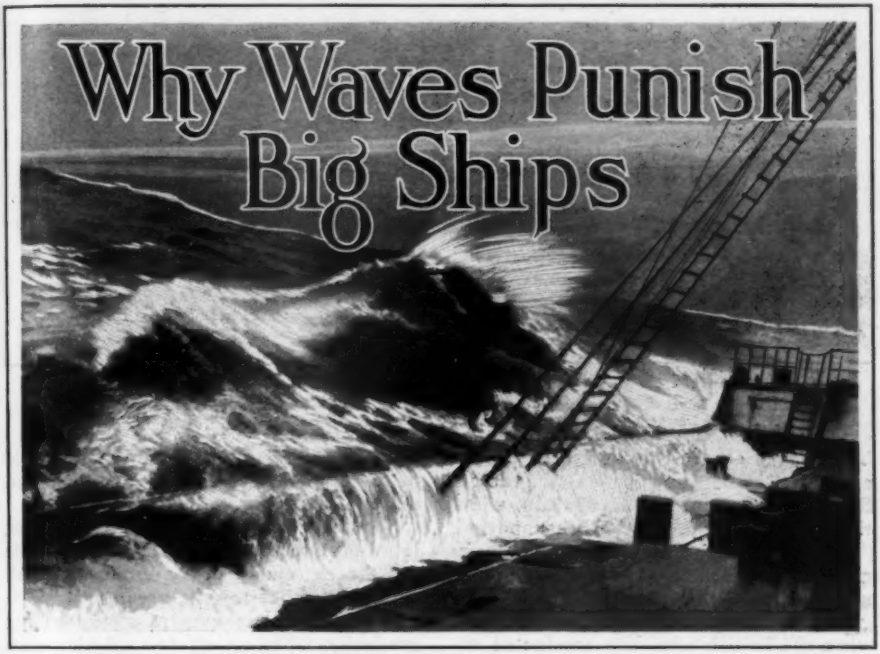
AUTO LIFTER ON RIM OF WHEEL AIDS IN CHANGING TIRE

Easily attached to the inner wall or felloe of the automobile wheel, a one-piece steel support allows raising of the car at a quarter turn of the wheel. This simplifies the task of jacking up the automobile for changing tires or other repairs.



Auto-Wheel Lifter in Use, and as It Is Mounted beside the Tire

Why Waves Punish Big Ships



Bucking the Water Mountains; This Photograph Was Taken by a Passenger on the S. S. "King Cuffyd," Bound from Australia for London, While the Vessel Was Passing through the Australian Bight

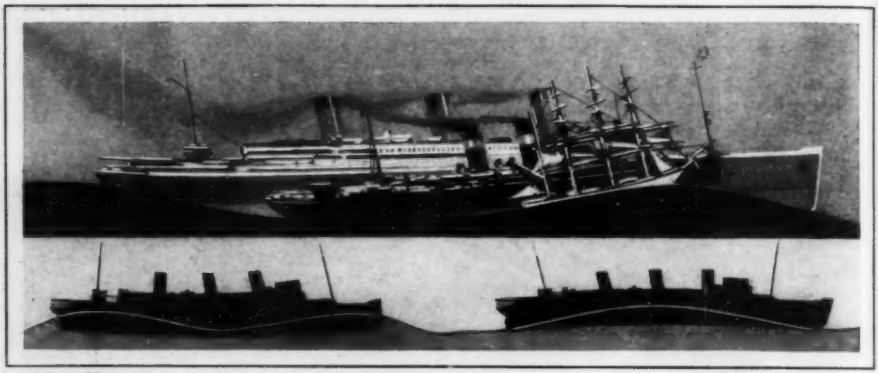
WHEN the "Olympic," the "Majestic," the "Leviathan" or the "Mauretania" steam into New York or Southampton many hours behind schedule, with rails, lifeboats, doors and even steel plates and girders broken and bent after a battle with a North Atlantic gale, and a smaller ship follows with no visible signs of punishment, the inference might be drawn that the big liner had been in the worst part of the storm.

Nothing could be farther from the truth.

In fact, the big ship has been the victim of its own size. One of the oldest unanswered queries is what would happen if an irresistible force met an immovable object. The nearest answer was obtained recently when the "Olympic" arrived with thirty feet of her forecastle railing missing, and on another occasion when the "Leviathan" docked with her deck fittings, boats and superstructure, all perched high above the water, reduced to twisted steel and splintered wood.

An automobile bumper is effective because it gives, and therefore absorbs part of the shock, instead of transmitting all of it to the car. In the same way, ships are built to give before the blows of the waves, for an entirely rigid vessel would absorb more punishment than it could stand. The smaller vessels, because they present less resistance to the thousands of tons of water hurled at them, actually suffer less than the big ships. The small steamer, however, is a rough rider for the passengers, while the size of the big liner makes it a comparatively stable affair, even in a gale.

Its size, though, and its great weight expose the liner to a variety of dangers. For one thing, its great length often exceeds the length of a wave, as measured between two successive crests, with the result that when the bow of the ship is climbing one wave the stern is on another, and the midship section is left with less than its usual support. Again, when the ship's length is less than the distance between wave crests, the great length of a liner means so many more feet of ship to



Courtesy The Illustrated London News

Diagrams Showing Effect of Waves on Different Ships; at Top, Note Where Strain Strikes Vessels of Different Size; Lower Left, an Illustration of the "Sagging" Effect, at Right, "Hogging"

be balanced on the wave crest, with both ends, partly unsupported, dragging down. Shipping men call the first strain, when the middle of the ship is unsupported, "sagging," and the other condition "hogging." Nothing much was known definitely about the laws of stress and strain governing either condition until 1903, when the British admiralty conducted extensive experiments with the torpedo destroyer "Wolf." The boat was placed in a drydock, first with blocks supporting it near the stem and stern, and again with supports amidships, and the water gradually lowered, six inches at a time, while the effect was measured.

From that experiment it was deduced that a ship might be exposed to stresses of six to seven tons per square inch, in the case of steamers 300 to 400 feet in length, and stresses up to ten tons might be encountered in larger ships. Both the length of the wave between crests and the height of the crest, which thereby determines the slope of the wave, affect the ship's behavior. One of the earlier British destroyers, the "Cobra," broke its back in a North sea storm, in 1901, on a wave that was estimated to have a slope of thirty per cent. Such a steep wave, only possible in a storm of extreme violence, is unusual, the average in the North Atlantic gales being nearer ten-per-cent slopes.

When the "Lusitania" was built, the designers allowed for a stress of ten tons to the square inch when on a wave of its own length and of a height not more than one-twentieth the length. Such a wave would be quite unusual, even in the most violent storm.

The excessive length of the great liners, in proportion to their depth, is responsible for the extremely heavy strains. In all ships, allowance for the greatest strain is made amidships, the extra strengthening gradually tapering off toward the stem and stern.

Another danger the big liner faces is due to its height above the water, not only of the hull but vast superstructure of cabins. In the old sailing-ship days, when a vessel's sails were furled, it offered comparatively little resistance either to wind or water. But with the liner, its weight makes it stand up to the blows of cross seas, and the tons of water thrown up against the superstructure often bend iron plates and stanchions like so many straws.

Seas vary greatly in various parts of the world. The British battleship "Albemarle," a 14,000-ton vessel, encountered a storm in the Pentland Firth, in 1915, during which a wave slapped the forward bridge and part of the conning tower overboard. In the Great Australian Bight, mariners have reported that the seas roll so high that a sailing ship can be virtually becalmed in the valley while the wind over the crests blows her topsails away.

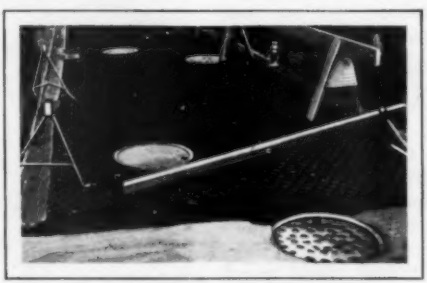
Another factor that captains and designers have to consider is the loading of the vessel. To the layman it might seem that a heavy cargo, well stowed as low down in the hold as possible, would make

the ship more stable and reduce the chances of turning over. Actually the cargo must be built up to the greatest possible height in the ship. In loading such heavy, shifting cargoes as iron ore, which, because of great weight, cannot fill the hold, it is necessary to build up bins or a "trunk" down the center of the ship, to distribute the weight upward.

The loss of the "Vestris" last winter is generally conceded to have been due to the presence of free water in the engine and fire rooms. A fairly small amount of water spread over a large area in the bottom of a ship may cause it to turn over, where many times the same weight, confined in tanks rising up through the holds, would involve no danger. The reason is that a few inches of free water spread over the bottom may so change what the ship designer calls the "metacentric height" of the vessel as to cause it to capsize. Every ship has a center of gravity and a center of buoyancy, both on the center line of the ship, when in good trim, with the center of buoyancy somewhat below the center of gravity. When the ship heels over in a storm, the center of gravity does not change, but the center of buoyancy moves toward the low side. A vertical line drawn from this point until it intersects the center line of the ship marks the metacenter, and the distance this point is above the center of gravity is the metacentric height. Therefore, a small amount of free water at the bottom of the hull may change the metacentric height, and exert a capsizing force well above the deck line.

IRON-MESH BASE FOR PAVEMENT TO PROLONG ITS LIFE

Reinforcing in the form of an iron-mesh "skeleton" has been introduced for street pavings. The spaces are filled with asphalt or cement and the base is expected to reduce cracking and other faults that shorten the lives of street surfaces.



Iron-Mesh Base in Place on Street for the Final Covering of Asphalt or Cement

Hunting for Leak in Water Pipe with the Aid of the Sensitive Listening Apparatus

MAGIC "EAR" FINDS BROKEN PIPE TO SAVE DIGGING

To locate broken water pipes, German scientists have introduced a sensitive electrical outfit that serves as a reliable detector and often saves much labor in digging for the defective pipe. The set is compact and portable and consists essentially of two membranes, microphones and headphones. The membranes and "mikes" are placed on the ground above the course of the water pipe, connections are made to terminals in the instrument case, and an electric current turned on. The sound made by water running out of the pipe and through the ground will be detected in the headphones, if the test is made at a comparatively quiet time and the pipes are not too far below the surface. By experimenting with the outfit at different spots, to determine where the sound is the loudest, the exact location of the break can be found.

Diver Passing through the Escape Tube, and Drawing to Show How the Device Could Be Used to Effect Rescues in Case of a Submarine Disaster

TUBE SHOOTS MEN OUT OF SUB TO SAFETY

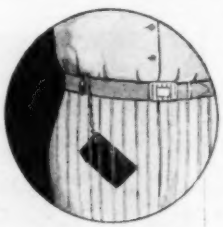
Italian naval engineers have been experimenting with an escape tube to effect rescues in case of submarine disasters. It is simply an outlet from the interior of the craft, the opening being so regulated that a man in diving helmet and a lightweight suit is forced out by compressed air and rises to the surface or is taken into a rescuing submarine also equipped with a similar tube. As shown by the accompanying sketch, the plan would be to transfer the crew of a wrecked submarine to the other. A cable would be attached to the tube of the sunken vessel so that the transfer could more easily be accomplished. In recent tests, men escaped from a submarine fitted with such a tube.

FLYING COURT SPEEDS JUSTICE IN ALASKAN WILDS

"Winged justice" is an actuality in Alaska, where officials and attendants of the fourth judicial district, including the central and northern parts of the territory, use an airplane in covering their jurisdiction. In a few hours, trips that would require weeks by boat or foot travel, can be made into remote parts of the territory. The first official air journey was made in 1926, when the first term of the United States district court was held at Wiseman. Sessions there previously had been impossible because of the remoteness of the place. Not long ago, a deputy flew from Fairbanks to Ruby and back in six hours. By dog team, the journey would have taken twenty-two days.

CHAIN PURSE INSIDE TROUSERS THWARTS PICKPOCKETS

Fastening a billfold to the belt by a chain and then wearing chain and purse inside the trousers instead of in the pocket is one man's idea to foil pickpockets. One end of the chain is fastened to a metal loop, and the other end, containing a crossbar, passes through grommets in a corner of the billfold, allowing it to hang suspended inside the trousers. The purse, fastened to the chain, also may be carried in the pocket.

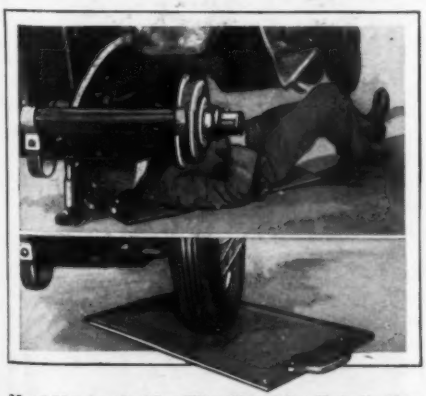


"CHEMIST" GUARDS TOWN'S WATER SUPPLY

To insure the constant purity of the water supply, a Swiss inventor has introduced an "automatic chemist" in the form of an apparatus that regulates the chlorinating process. It is always on duty, and every moment the purity of the water is automatically checked and recorded. The advantages of such a system would be especially marked in small towns where chemical analysis of the water is performed only at infrequent intervals, and since an epidemic may start in an hour's time from an unnoticed flow of polluted water, the outfit would be a valuable ally.

HEADREST ON CAR-REPAIR MAT HELPS PROTECT WORKER

Made of durable, non-rusting metal, a mat for the worker to lie upon while repairing the under part of the auto, has a headrest for comfort and convenience. The mat is without casters, hence will not slide or slip away while being used, yet can be moved about easily while lying upon it, simply by pulling or pushing while grasping any part of the car.



Metal Mat for the Man Who Must "Get Under"; Note the Pad for the Head

Inspecting a Portion of Talking Film for Defects, and Sample Strip with Part That Is to Be Cut Out

HOW DIALOGUE IN "TALKIES" IS CENSORED

Deleting undesirable portions of conversation from the talking pictures has been a difficult task at some of the producing studios, but the operation is often necessary to comply with the orders of the censorship boards and to correct errors. One way was to have the operators turn off the volume from the reproducer during the showing of the film, but this required rehearsals and great skill on the part of the projectionist. Where the sound pictures are registered on film, a better method has been found in using a small unit, somewhat like a tiny projection machine, through which objectionable words or passages could be detected and located before the film was edited and assembled. The director and cutter have earphones and a large lens through which they can see the film clearly as it passes through the machine. When parts that must be deleted are reached, the film is marked or punched to indicate what sections are to be removed and the rest of the strip is run off. Where only the vocal part is to be taken out, the sound track on the film is painted over with an opaque composition, preventing reproduction of words or other sounds at that point.

¶Traveling housekeeping schools are a success in France.

The Strange Quests

Japanese Women Gathering Beetles for Shipment to the U. S., and a Diver Seeking Deep-Sea Specimens

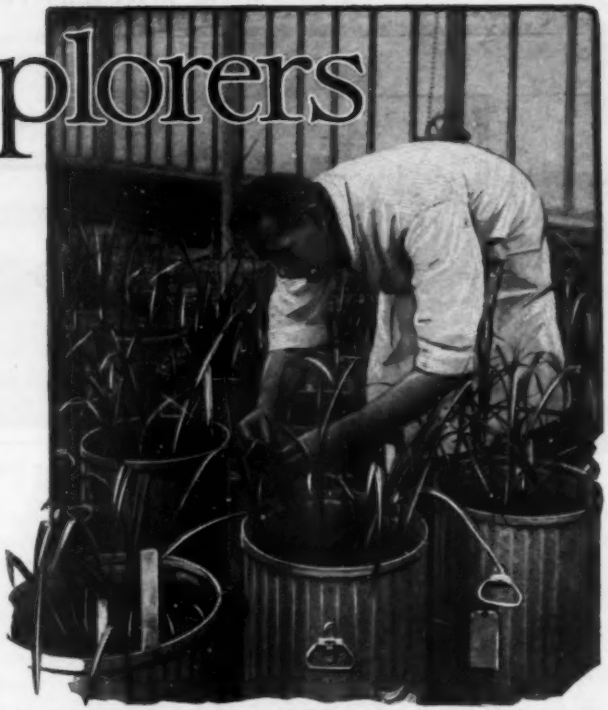
By C. MORAN

EXPLORATION parties which gather fish scales, samples of mud from the bottom of the sea, common dirt in far countries, dust from mines and industrial plants in all parts of the world, birds' stomachs and many other curious substances are sent out each year from Washington. These explorations to date have yielded a mass of scientific data that have proved of value in practical problems in industry, navigation and agriculture.

Expeditions are commissioned by the coast and geodetic survey to gather samples of mud from the bottom of the sea. These samples, which are obtained in cups attached to leads, enable the scientists to determine the character of the sea bottom in predicting the drift and formation of hidden shoals. This information is then plotted on mariners' charts. It is used also in the fisheries industry as a guide to the occurrence of schools of certain kinds of food fishes.

The bureau of fisheries recently has learned how to determine the age of fish from microscopic examination of the scales. Literally billions of fish scales are taken annually from fish in practically all American waters, after which the fish are liberated. The scales indicate the prevalence and age distribution of the various kinds of fish, and this information is used in forecasting future fish supplies. Scales of mackerel are now be-

# of Explorers



Dr. G. W. Brandes Examining a Collection of Sugar-Cane Specimens, Obtained in South Africa by Government Explorers

ing gathered along the Atlantic for this reason.

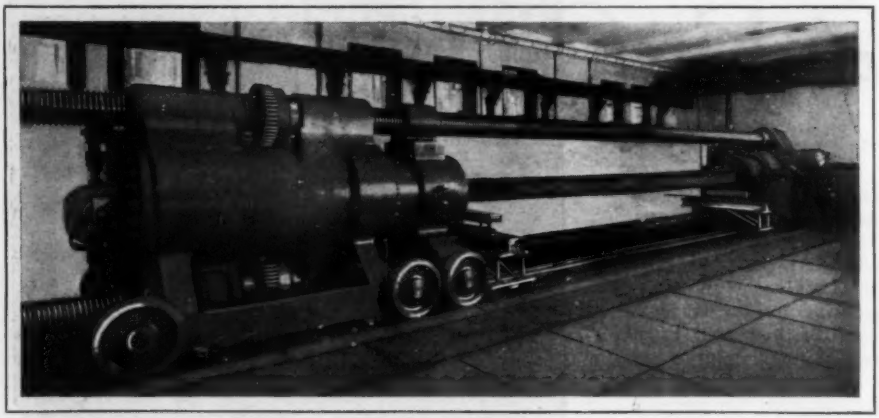
For many years the department of agriculture has been collecting samples of common dirt in all parts of the world, especially in farming areas adjacent to ancient civilizations, for the purpose of determining the reasons for the continued fertility of soils which have been tilled for centuries. The results of these explorations have refuted many former commonly accepted notions regarding the exhaustibility of the soil, and have supplied the foundation for more modern culture methods.

Specimens of oysters, ranging from the size of a dime up to a foot in length, and from a few ounces in weight up to several pounds, may be found in a laboratory at the bureau of fisheries where experiments are being made for the purpose of increasing the rapidly dwindling oyster crop in American waters. The oysters are induced to attach themselves to twigs and shrubs, and to congregate in wire baskets under water. The specialists explain that, when the oyster is hatched, it is free-swimming from two to three weeks, after which it seeks a firm object to which to attach itself. Should it settle in mud it may be smothered. The aim, therefore, is to provide firm substances to which oysters may attach themselves.

An unusual collection at the agricultural department includes specimens of plant tumors which have been gathered in studying crop diseases. This collection has attracted world-wide attention of medical men working with human tumors in the treatment of cancer. A collection of animal fats, gathered primarily in the study of live-stock diseases, has proved of value in conjunction with studies of human fat in medical research dealing with obesity. The collection now includes samples of human fat as well as specimens of animal fats.

What is said to be the world's largest collection of blood has been gathered by animal experts of the bureau of animal industry for use in the production of hog-cholera and other serums. Since the last nation-wide hog-cholera outbreak a few years ago, the scientists have resolved never again to be caught without adequate supplies of serum, and a large stock is now available in public and private animal-disease laboratories.

"Go to grass," or, rather, to "grasses," has a literal meaning for the government plant specialists, who have gathered from all parts of the world grasses ranging from a type which grows less than an inch a month, for use on golf greens, to that, such as the bamboo, which grows at the



Steel Girders Are Collected from Manufacturers and Users, and Tested in This 2,300,000-Pound Pressure Machine; a Girder Is Shown between the Two Ends of the Press

rate of a foot a day and may be used as windbreaks and for scores of other purposes. Many important grasses now grown in this country as forage for live stock had their origin in samples collected in old-world countries by plant explorers.

The bureau of mines has searched the world for samples of different kinds of coal dust, for use in developing preventive measures against coal-dust explosions in mines Highly developed instruments have been devised for determining the precise explosibility of these dusts, and recommendations issued for control measures in the mines in which the dusts are collected. Similarly, the chemistry experts have gathered all kinds of industrial dusts found in factories and on city streets, and developed formulas for preventing dust explosions.

Dust in the air at various heights is gathered in studying the so-called "smoke nuisance" in cities, and in determining the visibility of the atmosphere as a practical aid to aviators in locating landing fields and sighting buildings and other markers. The dust sample is gathered, usually on a sensitized plate, the dust particles counted and their distribution noted, much as in the case of an expert's examination of the pattern of shot discharged by a shotgun. The government collection of dusts includes literally hundreds of thousands of samples, ranging from dust found in tunnels to soap dust, starch dust, chocolate dust, sugar dust, and others.

A collection of bed sheets, gathered from hotels and other public places, was started recently by the bureau of home economics to determine the causes of wear of these fabrics. It has been learned to date that bad laundering methods are the chief cause of wear, and that sheets wear out sooner around the shoulders of the sleeper than at any other place. More conventional collections of this bureau include sewing machines, washing machines, and gas and electric ranges.

In the government greenhouses at Washington there is a unique collection of insectivorous plants, such as pitcher plants, sun dews, and venus traps, which are natural insect catchers. Plants of this type sometimes are gathered commercially and sold as fly catchers, but although the plants actually catch flies and other insects, botanists declare they are hardly a practical substitute for window screens and fly paper.

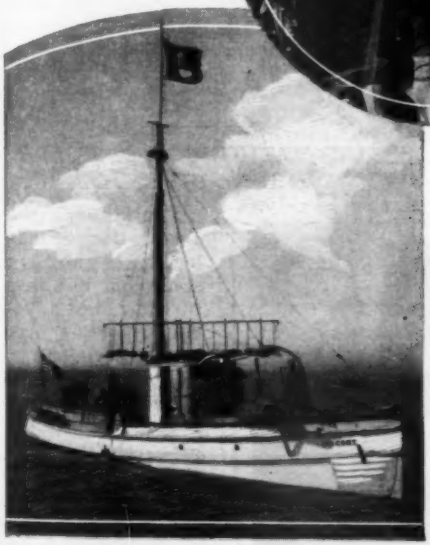
A collection of teas in one government laboratory includes every known variety grown throughout the world, as well as many tea substitutes, for use in establishing government tea standards. More recently, a collection of tin cans and other tea containers has been gathered to study their effect on the quality of teas.

Housed in the bureau of biological survey, there is a collection of feathers and plumes, most of which have been confiscated from violators of the migratory-bird laws. The survey also has a collection of

unusual guns, seized from pothunters, and ranging from ordinary shotguns to small-size cannon that slaughter hundreds of birds at a single firing.

More than thirty years have been devoted by the agricultural experts to collecting worms and similar parasites. This museum includes every conceivable kind of worm, from night crawlers to internal parasites of man and beast. The parasitologists declare that there are literally thousands of internal worms about which practically nothing is now known, although an index catalog of known pests lists more than 50,000 such parasites. This index is frequently consulted by animal-disease specialists in all parts of the world.

One might ask, naturally, why a government bureau should collect birds' stomachs. The answer is simply that only by analyzing the contents of a bird's stomach can the scientists determine whether a species is helpful or harmful to crops. Many thousands of stomachs of birds are gathered annually for this purpose, and the scientists thus have been enabled to classify the kinds of birds that eat the insects that destroy crops, and the kinds that eat the crops.



Coast-Survey Boat Used to Collect Marine Samples; Collection of Fly-Catching Plants, and Scientist Gathering Blood Specimens to Study Gas Poisoning

A list of strange and conventional substances in Uncle Sam's laboratories at Washington could be continued indefinitely. There are collections of canned soups and canned vegetables, chocolate-cream drops and other candies, sea foods, alligator and snake skins, animal hides, glue, grasshoppers, steel balls, tree rings, meteorites, and so on. These specimens are not gathered as curiosities but for practical use in developing new commercial industries and improving existing ones.

The visitor is informed, for example, that chocolate creams are gathered to determine why these candies explode sometimes; research with canned goods deals with the prevention of bacteria formation; steel tapes and girders are collected and subjected to unusual stress. Rare

Boring Instrument Used to Collect Samples of Soils at Various Depths, Ranging from Three to Six Feet

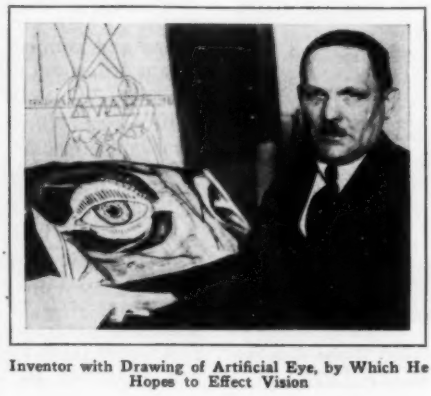
woods are gathered in developing stronger timbers, and for research in perfecting airplane struts and propellers. Uncle Sam collects string, not for economical reasons, but to develop new kinds of twine more durable than that which is now made commercially. A large assortment of fiber plants is gathered for the same purpose. Nuts and bolts are collected in developing precision screw and thread.

The casual visitor at Washington is not shown these collections of strange objects; he might not, upon hasty consideration, appreciate their practical use. They are the working tools of scientists who continually cooperate with industrial organizations in applying the results to commercial technique.

TOTAL ECLIPSE OF SUN NEXT YEAR VISIBLE IN U. S.

On April 28, 1930, the next total eclipse of the sun will be visible in California but it will last only a second or two, too short a time for extensive observations. Another eclipse will occur October 21 of that year, but the path of visibility misses land with the exception of two small islands which are almost inaccessible, so that it is doubtful if observation parties will go there. August 31, 1932, is the date of the next satisfactory eclipse, and it will be seen in eastern Canada and New England, over a path about 100 miles wide. It will last longer than the famous one of 1925, the chances of clear weather are excellent, and the sun will be higher at the time.

SEEING WITHOUT EYES IS AIM OF VIENNA INVENTOR

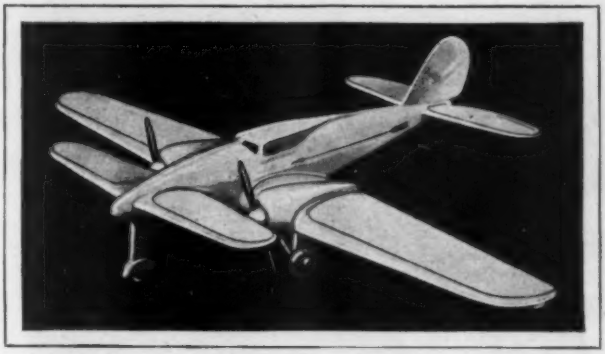


Inventor with Drawing of Artificial Eye, by Which He Hopes to Effect Vision

Working on the theory that sight is a wave process somewhat like that of the radio, a Vienna inventor has been experimenting with an artificial eye by which he hopes to give sight to persons whose optic nerve has not been destroyed. According to reports, his investigations have won the approval of medical experts.

THE FIRST PLANE INSTRUMENT

A piece of string between the wings of the airplane in which the Wright brothers made their initial flight twenty-five years ago, may rightly be termed the first navigation instrument for airplanes, and, in fact, was the father of the present highly developed turn-and-bank indicator. The Wrights in their first flights took turns lying flat midway between the wings, watching the string to indicate the balance of the plane and the amount of bank. It was the only means the pioneers possessed of determining whether they were gliding at a safe angle. The piece of string has been succeeded by instruments providing the flyer with senses far more accurate than his own.



Model of Safety Plane with Its Forward Wing and Skid; the Arrangement Is Said to Reduce the Likelihood of Stalling

SAFETY PLANE HAS FRONT WING TO PREVENT STALLING

Fitted with a supplementary forward wing and a three-wheeled landing gear, an airplane designed by an eastern engineer is said to provide additional safety as its center of gravity is farther forward than in the usual plane and it is not so likely to stall. The plane has a sixty-foot wing spread and is powered by two motors. The illustration shows a scale model, but the full-size ship will be built for a non-stop flight to Europe.

EARTHQUAKE TO SHUT OFF GAS TO PREVENT FIRES

In case of an earthquake, gas mains are automatically shut off by a special valve, developed by a western inventor to prevent fires. A pendulum is a feature of the unit, which is so adjusted that a quake of sufficient force to affect the mains will stop the gas from leaving them.

ELECTRIC SIGNAL WARNS PILOT FLYING OFF COURSE

For attachment to an airplane compass, an electric device developed in England, warns the pilot when he strays off the course. Deviation of but a few degrees from the course set actuates an alarm which flashes on the instrument board to inform the pilot that he is off the path.

MAGNET AUTO-TROUBLE LIGHT STICKS TO CAR

The base of an improved type of automobile trouble light is magnetized so that it may be affixed to any iron part of the car without extra fastenings. This simplifies the task of making repairs, as the lamp can be adjusted to many different positions. Another feature is the built-in switch, which makes it possible to connect the terminals permanently on the automobile, yet permitting the lamp and base to be freely moved about.

Views of Testing Apparatus Used in Examining Candidates for Auto-Driving Licenses in Berlin; Spots on Chart Indicate Lights

TESTS IN WHEELLESS AUTO HELP SELECT DRIVERS

Rigid examinations are given all persons applying for licenses to drive automobiles in Berlin, and before permits are issued, candidates must pass the tests, which are intended to eliminate persons unfit to manage a car. Included in the trials are a number of performances in a "dummy" automobile, simply a cab with all the controls and a mechanism whereby the candidate's rapidity of response to certain signals can be measured. Lights and other indications are shown on a screen, and the person in the testing car is rated according to the accuracy and speed with which he responds to the signals in manipulating the right controls.

ELECTRIC ENGINE HAULS THIRTY FREIGHT CARS

Further indications of the possibilities of electric power as a substitute for steam in railroad work were seen recently when an electric engine hauled a train of thirty freight cars a distance of ninety miles over the Rock Island lines. The interesting trip started from St. Joseph, Mo., where not many years ago the pony-express riders galloped forth to complete one link in a tedious relay across country. The test was declared to be the first in which an electric locomotive, generating its own power, had been used to haul a long freight train such a distance. The engine is forty feet long and has a 400-horsepower generator at each end. The traction motors are geared to operate at sixty miles an hour in passenger service with a five-car train, and at thirty-seven miles an hour with about thirty loaded cars or forty-five to fifty empty ones. The engine worked quietly and smoothly with no belching smoke. According to one official, the demonstration indicated that steam engines may be replaced by electric units over many miles of railroad lines in the next few years.

FLAT MATCHES CARRY ADS

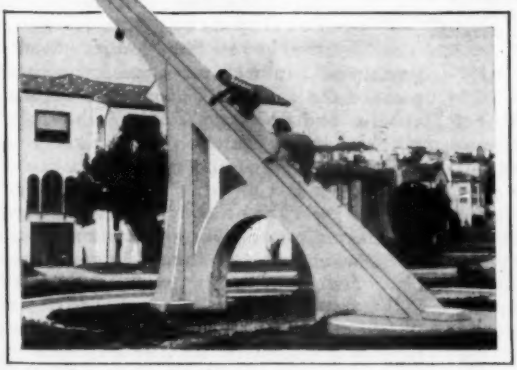
Flat match sticks, made to accommodate a complete printed sentence on each side of the stick, will permit the use on this household article of advertising slogans. The machine which turns out these matches also prints the message desired. The wood may be of a less expensive quality than that regularly used for the common grooved or round kinds.

ANTARCTIC REGION IS COLDEST PART OF THE EARTH

Contrary to general belief, the most intense cold on earth probably is found at the south pole rather than the north pole, Vilhjalmur Stefansson, explorer, says. The temperature in the antarctic shortly after midwinter is estimated at 120 degrees below zero, or even lower. At the north pole the corresponding temperature is probably only half as far below zero and from ten to thirty degrees warmer than the minimum sometimes reached in many places where both Europeans and Americans live. Exploratory work in the antarctic is not conducted at lower temperatures than those prevailing in the arctic, however, as the favorable exploring season for the northern regions is in the winter, but for the south polar regions it is in the summer.

SUNDIAL SERVES AS MARKER IN CITY SUBURB

What is said to be one of the largest sundials in the world is in a suburb of San Francisco, where it identifies a residential district. Its shadow can be easily seen at a considerable distance.



Huge Sundial Serves as an Impromptu Gymnasium; the Indicator Is Made of Concrete and Identifies a City Suburb

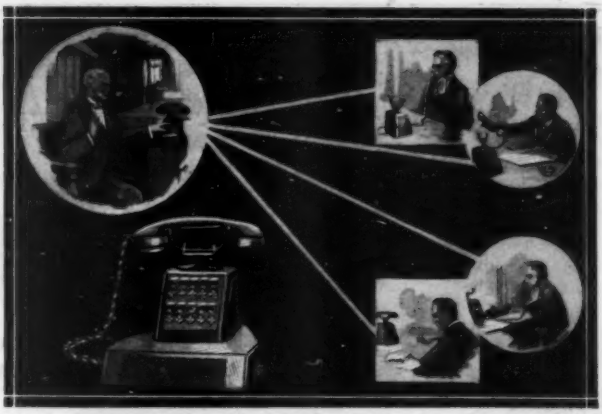
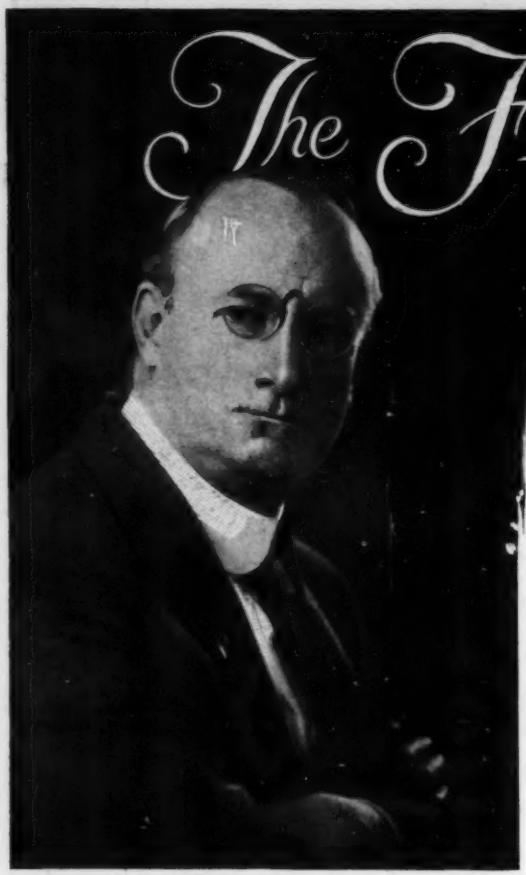


Diagram of the Conference Phone System in Use, and a Close View of the Instrument with Its "Switchboard"

CONFERENCE SYSTEM BY PHONE SAVES OFFICE TIME

Office conferences can be conducted without the participants leaving their rooms through a telephone system introduced in Germany. The instruments are of two types. One, designed for the officer or officers who have the right to call conferences, has a number of push buttons on the base, equal to that of his colleagues or subordinates whom he may wish to share in the council. He presses the corresponding buttons and, immediately, the phones in the other offices begin to ring. As soon as the officer lifts his receiver, a number appears in a window under the switches. The executive is thus able to see when all are in attendance at their telephones. He then announces the subject of discussion and need not keep the receiver to his ear, for there is a loud speaker in his set which enables him to hear what the others say. The head officer will always know when the other officials are speaking among themselves and can cut in on the conversation at any time or have his secretary placed in connection with them to give him a transcript of the discussion later. By calling upon the main switchboard for special connections, the system may also be used for intercommunicating service in the ordinary manner.

The Flying



Dr. W. W. Christmas, Inventor and Scientist, Who Has Contributed Many Notable Discoveries to Aeronautics

By MYRON M. STEARNS

A GIANT passenger airplane, 200 feet from tip to tip, capable of accommodating seventy-five travelers in luxurious comfort, besides carrying its regular crew of captain, navigator, pilot and assistant pilot, engineers, chefs, stewards and mechanics, has been designed and, if plans already nearing completion are carried out, will be under construction in the course of a few months—the first of a fleet of great air liners to approach the problem of commercial air transportation from an entirely new angle. As projected, each ship will have a main dining salon forty feet long and seventeen feet wide, two separate engine rooms, each with three 1,200-horsepower, eighteen-cylinder motors, and two huge twenty-seven-foot propellers revolving at comparatively low speed.

The inventor is one of the oldest designers of successful aircraft in the country, the third man to fly, on March 8, 1908, in a heavier-than-air machine of his own construction, and who has since turned out scores of planes embodying innovations now used in practically all successful aircraft construction.

To those unacquainted with the intricacies of aeronautical development, with its early workers, like Father Montgomery of Santa Clara college, who have escaped the limelight, as well as those, like Orville and Wilbur Wright, who have glittered in the center of it, the story of Doctor Christmas' life runs like a fairy-tale.

Born in Warrenton, N. C., in 1865, his first investigations of the air came with kites, when he was about sixteen years old. His biggest kite was eleven feet high; it took three men to hold it in a strong wind. Once he caught the light rope of a somewhat smaller kite around his arm, and was pulled into the air; if a companion hadn't been there to grab the

One of Doctor Christmas' Designs of Several Years Ago; in Later Models, He Has Eliminated the Central Passenger Fuselage and Moved Living Quarters into the Thick Wing

rope and help pull him down, although it cut his arm badly, he would probably have lost his life. Always his interest was not merely in whether or not the kites would fly, but in how much they could pull, or where the rope could most effectively be attached.

It was through his connection with Dr. Samuel P. Langley, with whom he was associated later in life, that Doctor Christmas was more closely drawn into early aeronautical development. He became absorbed in studying the flight of birds, believing that here would be found the key that would unlock the door leading to conquest of the air. He caught and kept birds to see how much they ate, weighing every scrap of food they consumed in two weeks' time, burning the equivalent and measuring the energy it produced, finding that a bird ate in a fortnight only enough fuel to give power, in terms of such aerodynamics as we are acquainted with, for a few hundred yards' flight. Yet, on that food, a bird could fly hundreds of miles. He tried clipping a quarter of an inch from the tips of birds' wing feathers, then releasing them to watch what adjustment they would make in flying. Then he tried clipping off a half inch. Once he tried filling a bird's wing feathers with glue, keeping it until it hardened, to see if the bird could fly with rigid wing surfaces. It could not, and in making the effort, it actually tore its breast muscles loose and died.

At a lecture delivered in 1919, he told of the three air currents that a bird utilizes in flight—the upper current that forms a vacuum over the rear of the wing, the under current that lifts, and the little-known third current that passes upward through the wing, and that has recently been utilized to a certain extent in the slotted wing and similar devices. More than ten years ago, also, he wrote of the static elec-

tricity generated by a bird's wing feathers in flight, calling attention to the fact that, in an airplane wing, this was almost wholly absent, while in the case of soaring birds it was most abundant, and suggesting that here lay one of the hitherto unsuspected factors of successful flight, the static charge acting to repel the static electricity of the earth, and so reducing, or at times even overcoming altogether, the pull of gravity. It is through the utilization of this principle that scientists have only recently been able to make a highly charged metal rod lie unsupported in the air without falling.

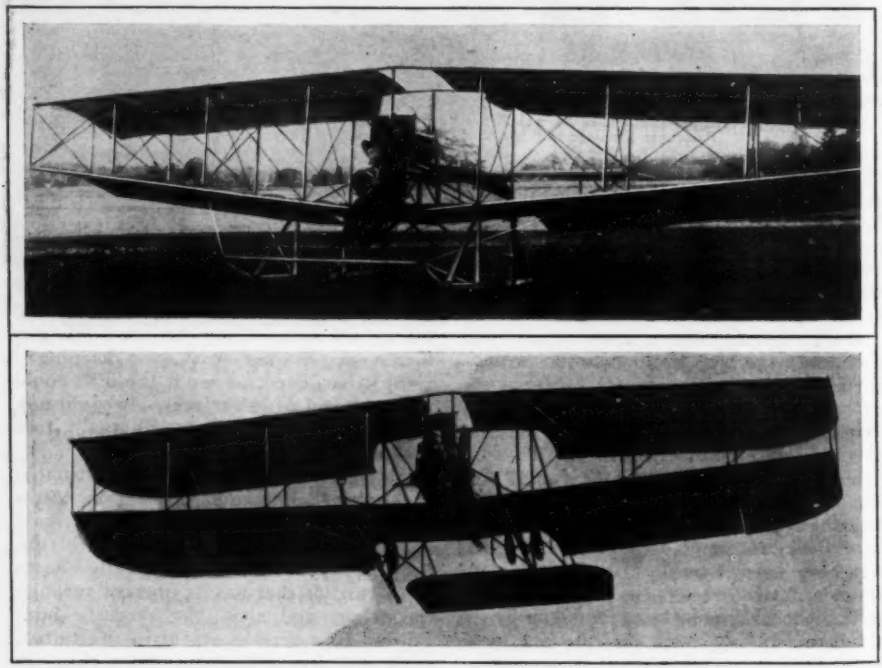
"My first plane wasn't ready to fly until 1908," he says. He flew it himself. "Scared? I had too much to think about. All I wanted to know was whether it would get off the ground or not."

It did, for several hundred feet, rising to a height of five or six feet in the air. "The only thing that made it possible for me to keep up even that long," Doctor Christmas declares, "was the ailerons, the first to be used on any airship."

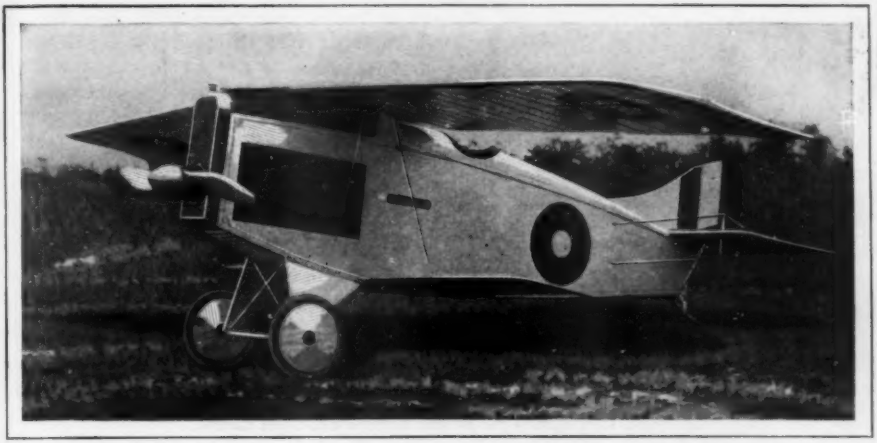
He made several flights in that plane, all but a couple of them in a comparatively straight line, and never getting more than twenty feet or so above the ground. "Then she got away from me. One wing went into a tree. I was only about six feet up, going perhaps thirty-five miles an hour. Of course the plane smashed, and I slithered out along the ground."

In one of the many models that he made during the next two years, there was one accident that threatened to be much more serious. The radiator broke loose when the machine hit a bad bump before the take-off. It was placed, as in the early machines, behind the pilot, and Doctor Christmas was dangerously scalded.

In 1910, he began making a series of planes he called "Red Birds," flying them at College Park, outside of Washington. On Oct. 11, 1911, a young navy yard mechanic, named George Fisher, made an accidental flight in one of them. Intending only to "taxi" it along the ground in a test, he found the plane taking the air



One of the Earliest Christmas Planes, with Hinged Ailerons at the Wing Tips, and, Below, a View of the Machine in Flight; Note the Skis and Double Landing Wheels



Before Its Time; a Short-Fuselage, Thin-Wing High-Speed Plane, the Christmas "Bullet," Designed in 1918; Many Points of Its Design Have Since Been Utilized in Other Ships

under him. He had never flown before, but the plane was so well balanced that he got down without accident. One of the 1910 "Red Birds" was flown by Paulhan, the famous French air pioneer, and other foreign pilots. In his early planes, Doctor Christmas was interested particularly in low-speed planes that would fly on a minimum expenditure of energy, after the manner of the best bird flyers, the hovering birds. One of them would stay in the air at only twenty-seven miles an hour. In 1912, he built the biggest plane that had ever been flown up to that time, with a wingspread of eighty feet. It was the forerunner of the big modern bombers. In 1916, he built an all-metal plane, the first of its kind.

During his observation of birds, Doctor Christmas had been greatly impressed with the "flicker" along the trailing edge of a bird's wing during flight. He worked out the relationship of this up-and-down weaving to the different air currents, and, as a result, put a flexible edge on one of his plane's wings. "Before this," says Doctor Christmas, "that particular plane had made forty-six miles an hour. With the flexible edge on the wing it made seventy-two." This led him, in 1918, to design what was perhaps the most famous of all his planes, known as the "Christmas Bullet."

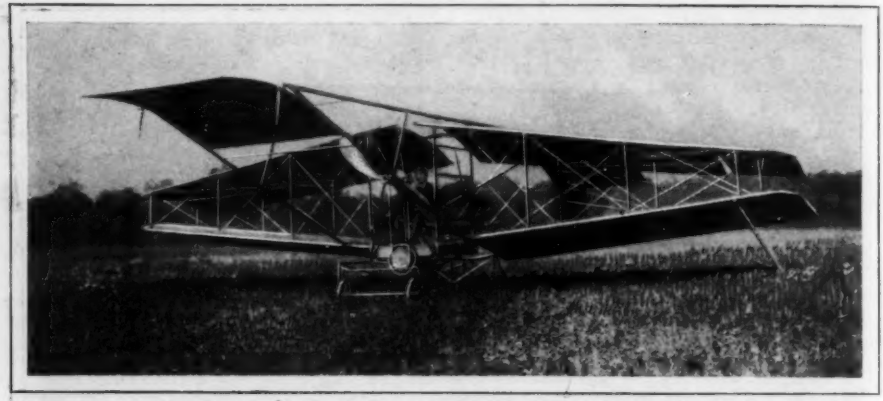
It was a sesqui-plane—the first. It was strutless; the wings were unsupported. The wings were staggered, the front edge of the lower wing being set well behind that of the upper. Most important of all, the wings were flexible, adjusting themselves in a measure to the varying pressure of air currents during flight. It was this plane of which an account in a New York newspaper read: "The Christmas 'Bullet' has gone a long way toward what will be, of course, the ideal airplane—a plane whose wings are like those of a bird, flexible, movable, and subject to the control of the pilot."

The plane developed great speed. "A new world's record for speed," runs an account in an Indianapolis newspaper, "was made before Colonel Harmon and his staff. The Christmas 'Bullet' made in excess of 170 miles per hour with the engine at three-quarters throttle."

"The first motor we put in," Doctor Christmas says, "was 160 horsepower. Later we changed to 200. With that, we recorded a speed of 222 miles an hour. That still stands as a world's record for speed per weight per square foot of lifting surface per horsepower.

"I haven't had time to think about money. I've been too busy with more important things. The United States government paid $100,000 for one of my patents—the hinged aileron."

After designing the "Bullet," Doctor Christmas had a long siege of illness. It culminated the ups and downs of a series



When Wheels Entirely Replaced Skis, a Christmas Plane Built in 1909; the Inventor Was One of the Earliest of Flyers, Ranking with the Wright Brothers and Glenn Curtiss

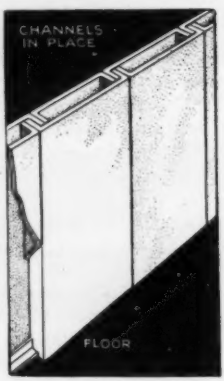
of adventures running back over years in which he was spied upon, stabbed and shot at. Once a wing panel of one of his planes was sawed in two; only a timely discovery of the tampering, in all probability, prevented a fatal accident.

Since his recovery, his work in the field of aviation has been confined to designing the big passenger planes mentioned at the beginning of this article. He has to his credit, however, several inventions in fields other than aerodynamics.

"The flying wing," he says, "is the commercial plane of the future—the plane without a wind-resisting fuselage, in which the space inside the wing itself can be used for engine space, passengers' staterooms, and crew's quarters, as well as for fuel tanks and mail compartments and general cargo."

CONCRETE THAT CAN BE SAWED TO REDUCE LUMBER WASTE

For various types of buildings, channel walls which are constructed of concrete and can be sawed and nailed like lumber, have been introduced by F. W. Fitzpatrick, consulting architect, as an improved method of construction and as a way of utilizing quantities of lumber now being wasted. His patented plan involves the use of interlocking members of concrete, a preferred material, so arranged that channels are formed in the walls. These create a dead-air space which may be sufficient insulation in itself, or other materials may be placed in the channels for additional protection. The space is also suitable for pipes, wiring or for extra reinforcing. The concrete mixture of which the wall units are prepared, embodies wood fiber from waste lumber and is strong and light in weight.



SOUND EXERCISES FOR EARS HELP RELIEVE DEAFNESS

By giving ears exercises in response to sounds of varying frequencies, specialists are reported to have made considerable progress in overcoming some cases of deafness. The patient's degree of hearing is first determined with apparatus that registers sound waves, vibrating as slowly as 106 times a second. From this point, the frequency is increased to as much as 12,000 vibrations per second. If the hearing of the subject responds to any of these vibrations, sound waves of increased intensity are transmitted to the ears through

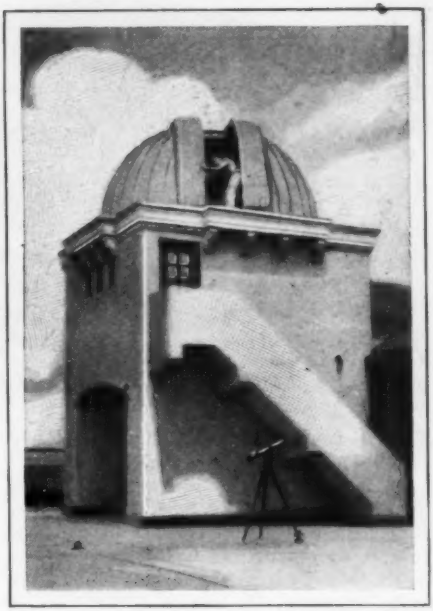
earphones. The effect is described as being like a curative massage, stimulating the auditory nerve into activity. One engineer has developed a method of treating cases of chronic deafness with sound waves that vibrate so rapidly they are inaudible to human ears, the usual frequency being 30,000 vibrations per second.

OLD BRIDGE AS FLOWER GARDEN HELPS ADVERTISE TOWN

Motorists and other travelers passing through Shelburne Falls, Mass., are attracted by a bridge of flowers and evergreen trees, spanning the Deerfield river. An abandoned viaduct, once used by a trolley line, has been transformed into a bower of blossoms and vines that creep down the concrete sides of the five arches of the bridge and climb over the iron supports that once held the trolley wire. The idea was originated and financed by the women of the village, and a skilled landscape gardener was hired to do the planting and superintend the work. A windbreak was established on the north side by erecting a wire fence, six feet high, as a trellis for vines. This does not interfere with a view of the bridge, which is seen from the south by persons approaching the village. The old ties and rails were

Sketch of the Bridge of Flowers at Shelburne Falls, Mass., an Old Viaduct Made into a Bower

removed, and rich soil was spread for the plants, dwarf cedars and other evergreen trees. The bridge is 375 feet long.



Observatory Dome on Top of the Galileo High School in San Francisco; It Has Two Telescopes

HIGH SCHOOL HAS OBSERVATORY IN HONOR OF GALILEO

Students of the Galileo high school in San Francisco are enabled to study astronomy direct from the heavens through a five-and-one-half-inch refracting telescope and a five-inch reflector installed in an observatory on top of the school building. The revolving dome and other features of the installation are modeled closely after those of larger observatories, while the funds for the telescopes and mounting were raised by the students themselves. The school is named in honor of Galileo, the famous Italian astronomer and scientist.

NUTS KEPT IN COLD STORAGE FROM SEASON TO SEASON

By keeping them in a temperature of thirty degrees Fahrenheit, pecans have been preserved from one season to another by the bureau of plant industry. The chief advantage of the system is that surplus from a heavy crop one year might be kept for profitable marketing the next

Home-Built Steel Launch Constructed for a Trip across the Atlantic; the Final Destination Is Hamburg, Germany

STEEL LAUNCH TO CROSS OCEAN BUILT IN A BARN

In a twenty-six-foot steel cabin launch, which he and helpers built in a barn, Joseph Leppich, of Coldwater, Mich., hopes to sail across the Atlantic to Hamburg, Germany. He was to start from Toledo, Ohio, go down Lake Erie and Lake Ontario into the St. Lawrence river, and at St. Johns, Newfoundland, take on 380 gallons of gasoline for the proposed trip to Ireland, a distance of 1,700 miles. The craft passed successful tests on Lake Michigan shortly after it was launched. Four young men who helped build the boat, planned to accompany Leppich.

GRAPPLE PLANT KILLS LIONS GOATS AND ANTELOPES

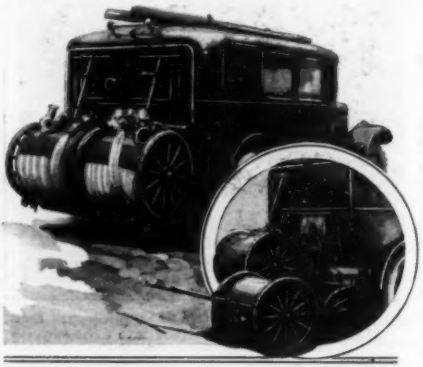
The lion may be the king of beasts, but it finds its equal in a strange plant that grows in South Africa. It is known as the grapple plant and has a large number of curved hooks on its seed vessel. These catch in the coats and feet of the animals and, in trying to tear them out, the lions sometimes get them in their mouths with disastrous results. Many antelopes, goats and other animals are lamed and injured by this plant every year. In South America is a fruit that produces hooks five or six inches long. These also injure animals. An Indian species of nettle is shunned by beasts and human beings alike. When touched, it produces the sensation of being scrubbed with a hot iron.

MORE THAN QUIET IS NEEDED, NOISE TESTS REVEAL

Eliminating unpleasant noises is a matter of regulating pitch rather than getting rid of the annoying sounds entirely, the Acoustical Society of America has decided. Experiments showed that mere quieting of racket often did not eliminate the unpleasantness, and in fact might add to it. Dr. Donald A. Laird, of Colgate university, who conducted experiments on students, said that under some conditions a small reduction in loudness was accompanied by a distinct feeling of relief, while under other conditions a much greater reduction in loudness did not bring a proportionate sense of relief.

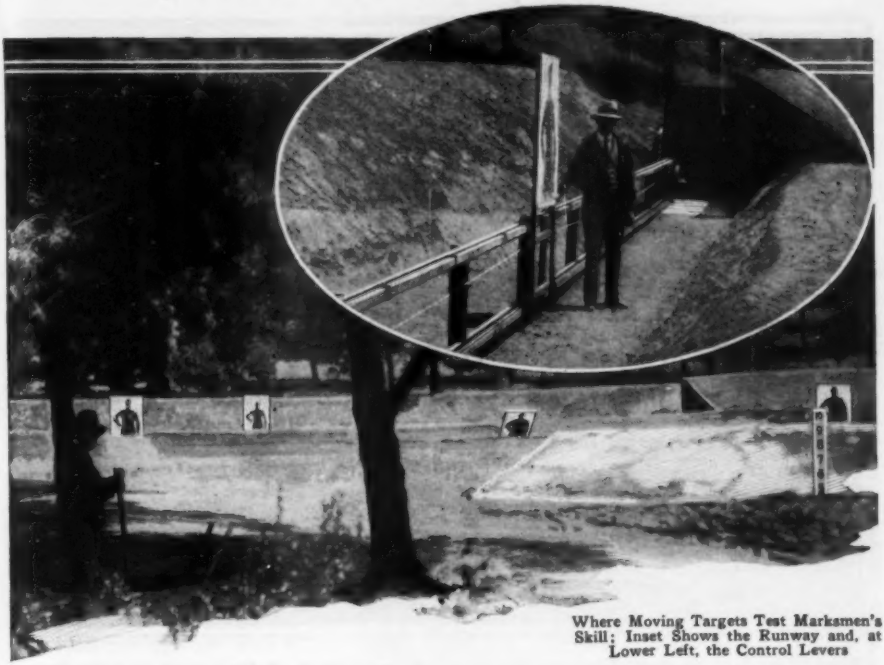
INCLOSED FIRE ENGINE GUARDS CREW FROM STORMS

Members of some of the fire squads in Paris, when responding to alarms, ride comfortably in a car that resembles a limousine more than a fire engine. It is completely inclosed, to protect the men from wet and cold, and is used especially when long runs must be made. The plan has been found effective, since the crew is spared unnecessary fatigue.



Courtesy M. Andre

Views of the Closed Fire Wagon Used in Paris, Showing the Way Hose and Other Equipment Are Carried



Where Moving Targets Test Marksmen's Skill; Inset Shows the Runway and, at Lower Left, the Control Levers

TARGET RUNNING ON TRACK IMPROVES POLICE AIM

To develop good marksmanship among members of the Los Angeles police department, use is made of a man-sized target that is run on a steel track. It is moved back and forth across the range by means of an endless cable and the object is to hit it below the shoulders and above the hips. The target is especially helpful in developing the ability to aim and fire with great rapidity.

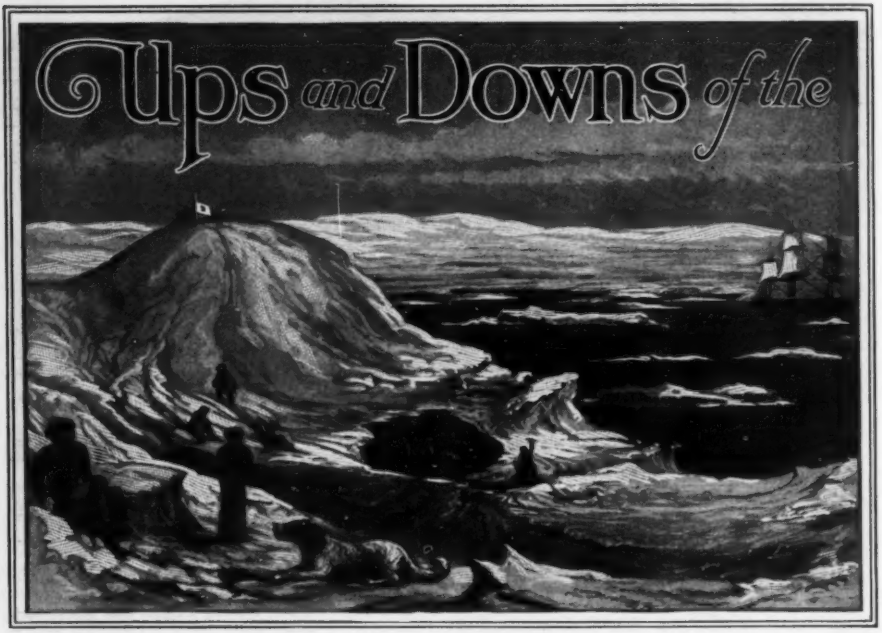
BARGE BUILT LIKE SUBMARINE TO PASS UNDER BRIDGES

To enable a self-propelled barge, 246 feet long and with a 2,500-ton capacity, to pass under the numerous bridges across the Chicago river, the barge has been constructed on the submarine principle. Instead of waiting for each successive bridge to be raised, the barge ducks beneath them by filling water-ballast tanks which lower it into the water. It is propelled by Diesel engines and has a speed in still water of ten miles an hour. The tanks run the length of the barge and, when filled, will lower the empty craft about six feet, and if still more room is needed, other compartments can be flooded. After the barge has passed the last bridge, powerful pumps are used to empty the ballast tanks.

SHIELD FOR AUTO HEADLIGHTS ELIMINATES GLARE

Easily attached or removed, a blue-center shield with an amber-colored border for the automobile headlights is reported to be effective in reducing the glare. The intensity of the rays is but little diminished, but they are spread over a wider radius, and the amber color is said to give the light greater effectiveness in fog. On fire and police department cars, a shield with a red center is employed to distinguish them from private vehicles.

Ups and Downs of the



Sketch of the Antarctic Coast, Made by Lieut. Charles Wilkes, U. S. N., in 1840; the Coast in the Background Later Was Found to Be More Than Fifty Miles Farther South

By CALVIN FRAZER

"NOW you see it and now you don't," is a game that nature is fond of playing with things along the horizon. Looking across a plain or valley on a certain day, you see a distant mountain peak. Another day it is invisible, though the air is as clear as before. A shore comes into view across a water surface at one time and vanishes at another. Not only do objects thus appear and disappear, but when they are visible, their apparent shapes undergo curious alterations. Sometimes they seem to be suspended in the sky and occasionally they are seen there upside down. All these appearances are the results of the refraction or bending of light in its passage through the atmosphere.

The commonest effect of atmospheric refraction is to make objects near the horizon seem elevated above their real positions. The elevation amounts on an average to about half a degree, which is approximately the same as the angular diameter of the sun and the moon. Consequently, when either of these bodies appears to be just above the horizon, it is actually below it and would be invisible if there were no atmosphere to bend the rays of light. Thus refraction advances the time of sunrise and retards the time of sunset by three or four minutes in our latitudes, while in the polar regions, where sunrise and sunset occur more gradually on account of the sun's nearly horizontal path in the sky, the sunlight period is lengthened a day or two by this process.

Ordinary refraction, by curving the rays of light that come to us from distant objects, enables us to see them for a certain distance around the "bulge" of the earth. If the earth were a larger sphere than it is, and the curvature of its surface consequently were less, the same amount of atmospheric refraction would give a greater range of visibility. Dr. W. J. Humphreys, in his "Physics of the Air," has called attention to the remarkable fact that on a planet about six times as big as ours, and having a similar atmosphere, people could see all the way round! It is difficult for

Horizon

us to imagine what the "horizon" would look like under such circumstances.

Refraction depends upon inequalities in the density of the air at different levels, and these inequalities are subject to variations, due chiefly to variations of temperature. Hence the amount of refraction varies. Sometimes the apparent elevation of distant objects is much greater than usual, and these objects are then said to "loom." This phenomenon is quite familiar to sailors. One effect of looming is to bring into view objects ordinarily below the horizon, and another is to make distant objects seem—mainly because we associate a certain apparent altitude with a certain distance—nearer than they really are.

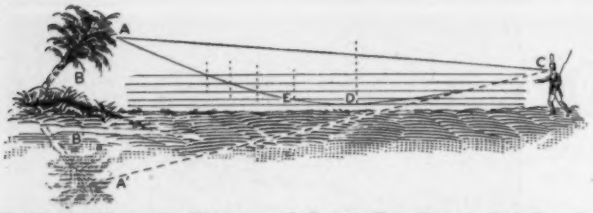
Mirage at the Eiffel Tower in Paris, Showing an Inverted Image; This Sketch Appeared in l'Astronomie in 1890

Good examples of looming may be seen at Chicago, where at times portions of the eastern shoreline of Lake Michigan become visible. From the upper stories of skyscrapers, in clear weather, people occasionally see the city of St. Joseph, Mich., sixty miles distant. This is likely to occur when the lower air over the lake is colder and hence denser than usual, while the air at higher levels is relatively warm and rarefied. An observatory on the Tribune tower is 456 feet above the lake and the shore at St. Joe is about 150 feet above the lake. The limit of direct visibility from the observatory is twenty-eight miles under average atmospheric conditions, but may reach Michigan City, Ind., forty miles away, under somewhat uncommon conditions, while under very exceptional circumstances objects might be seen over a level surface of land or water as far away as St. Joseph or even farther.

Many interesting and remarkable cases of looming have been reported from other parts of the world. In some of these, objects not only seemed to be lifted above their normal positions but also to be drawn out vertically on account of unequal refraction at different heights (a phenomenon sometimes called "towering") or to be otherwise distorted. People who have seen St. Joe from Chicago all remark that the buildings in the distant city appear too large. Thomas Jefferson, in his "Notes on the State of Virginia," tells of an instance in which a canoe containing three men, seen at a great distance from Yorktown, was mistaken for a ship with its three masts.

He was much interested in the effects of atmospheric refraction on distant mountains as seen from Monticello. Of this, he says:

"There is a solitary mountain about forty miles off in the south, whose natural shape is a regular cone, but . . . it sometimes subsides almost totally in the horizon; sometimes it rises more acute and more elevated; sometimes it is hemispherical; and sometimes its sides are perpendicular, its top flat and as broad as its



The Desert Mirage; the Observer, at C, Sees the Palm Tree, A, Both Directly and Also as an Inverted Image at A', Creating the Illusion of Reflection in a Body of Water

base. In short, it assumes at times the most whimsical shapes, and all these perhaps successively in the same morning."

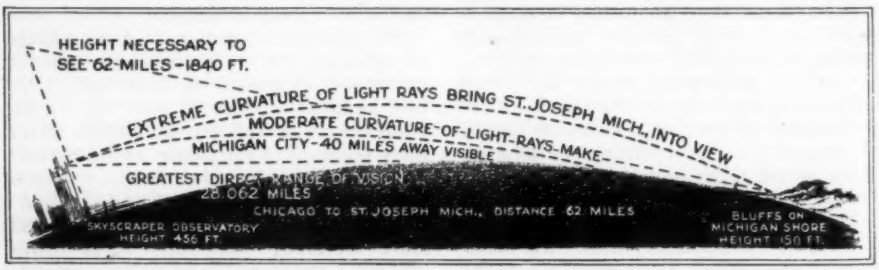
During the French military expedition to Algeria, in May, 1837, M. Bonnefont, a scientific member of the expedition, observed a flock of flamingos about three and a half miles away. As they started to fly, they assumed such enormous dimensions as to give the idea of Arab horsemen defiling one after the other. So complete was the illusion that a spahi was sent to reconnoiter.

When he reached the point where the birds had been observed, his horse's legs were seen to become so elongated that the animal appeared to tower many yards above the desert.

The sun, when close to the horizon, normally assumes an oval form, much flattened below, because refraction is greater on the lower side of the disk than on the upper. At times, however, on account of marked inequalities in air density, it is seen to be distorted into a great variety of queer shapes. It may take the form of a boy's top, a soldier's trench helmet, a mushroom, etc., or even divide into two separate and much flattened suns. The disk of the moon undergoes similar distortions. Many descriptions and pictures of these curious appearances have been published, including a large collection of photographs taken at Lick Observatory, on the summit of Mount Hamilton, California. The examples shown in the accompanying illustration were drawn in the Antarctic by Doctor Arctowski, of the "Belgica" expedition.

Some kinds of atmospheric refraction are especially common in the polar regions, and in two cases this phenomenon appears to have been responsible for celebrated geographical errors. In the first case, Lieutenant Wilkes, of the United States exploring expedition, charted the coast of the Antarctic continent at several places where subsequent explorers found only water, and a controversy has raged for generations over the merits of his discoveries. Probably Wilkes was misled by the looming of the land and greatly misjudged its distance. The second case was that of the mythical Crocker Land, which Peary thought he discovered in 1906. After it had figured on the maps for years, it was proved to be non-existent, but the Crocker Land expedition, which went north to explore it, saw from the mountains of Grant Land the same great loom of the arctic ice that Peary had mistaken for land.

On the other hand, Captain Scott, Borchgrevink, and other polar explorers, have at times found looming a useful means of locating both land and ice fields lying beyond the normal range of visibility. Toward the close of the eighteenth century, while Napoleonic wars were in


HEIGHT NECESSARY TO SEE 62 MILES - 1840 FT.
EXTREME CURVATURE OF LIGHT RAYS BRING ST. JOSEPH MICH. INTO VIEW
MODERATE CURVATURE OF LIGHT RAYS MAKE
MICHIGAN CITY - 40 MILES AWAY VISIBLE
GREATEST DIRECT RANGE OF VISION
28.062 MILES
CHICAGO TO ST. JOSEPH MICH., DISTANCE 62 MILES
SKYSCRAPER OBSERVATORY
HEIGHT 456 FT.
BLUFFS ON MICHIGAN SHORE
HEIGHT 150 FT.

Observers atop the Chicago Tribune Tower Frequently See Michigan City, Out of Sight below the Horizon, and on Rare Occasions Have Seen St. Joseph, Mich., Looming against the Sky

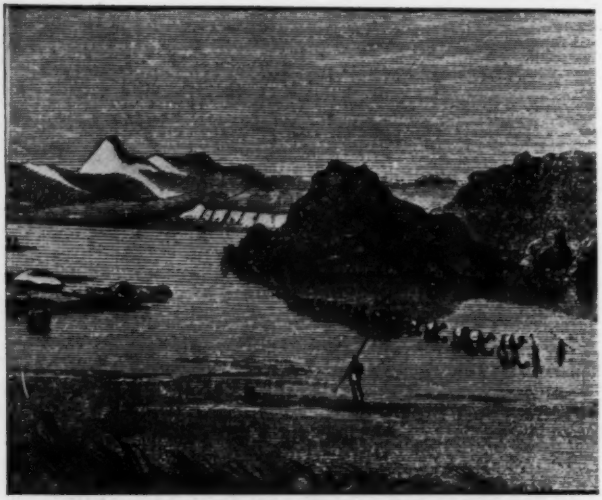
Old Sketch of an Unusual Mirage, Showing One Inverted Image of a Near-By Ship and a Double Image, One Upright and the Other Inverted, of a Distant Three-Masted Vessel

progress, an English philosopher, Doctor Vince, suggested posting lookouts to watch for the loom of approaching French warships. About the same period, popular interest was aroused in the claims of a Frenchman named Bottineau, a resident of Mauritius, who was said to be able to detect vessels at a distance of hundreds of miles by means of peculiar appearances in the sky. It is probable, however, that Bottineau's so-called art of "nauscopy" was either humbug or based on self-delusion, and had nothing to do with atmospheric refraction.

The term mirage is applied to several varieties of atmospheric refraction, particularly to those that entail a phenomenon akin to reflection and thus show objects in an inverted position. In the "desert mirage," also known as "inferior mirage," the first scientific account of which was given by Monge, a savant attached to Napoleon's army in Egypt, a layer of rarefied stagnant air overlying a hot surface mirrors the sky, thus producing the appearance of water, while the images of terrestrial objects, such as trees, depressed and inverted by the mirage, look like the reflections of the same objects upon the liquid surface. The desert mirage is by no means peculiar to deserts. It can often be seen over a hot city pavement. A favorable place to see it is at the foot of a gentle slope with your eye about on a level with the crest of the rise, where vehicles and pedestrians look as if they were splashing through water.

One region in the United States that has become somewhat celebrated for its mirages is the Red River valley, along the boundary between Minnesota and North Dakota. Dr. Warren Upham, the geologist, states that mirages may be seen here almost any sunshiny day in spring, summer or autumn. He says:

"This queer phenomenon makes the high land at the sides of the valley and the tops of the distant hills appear to be raised a little above the horizon, with a narrow strip of sky between. The more complex and astonishing effects of mirage may be seen from the high land on either side. There, in looking across the valley from one and a half to two hours after sunrise on a hot morning following a cool night, the groves, houses, villages and grain elevators loom up to two or three times their true height, and places ordinarily hidden by the curvature of the earth are brought into view. Oftentimes, too, these objects are seen double, being repeated in an inverted image close to their



Drawing of a Desert Mirage in Which a Camel Train Apparently Walks through a Lake, and Mountain Ranges Loom in the Background

real position and separated from it by a foglike belt. In its most perfect development, the mirage shows the upper and topsy-turvy portion of the view quite as distinctly as the lower and true portion."

Mirage that shows direct or inverted images of objects in the sky is more common over water than over land, and the phenomenon has given rise to a number of nautical legends, especially the familiar one of the Flying Dutchman. An inverted image of a ship, for example, may be seen in the sky when both ship and observer are in a layer of relatively dense air overlying the water, while farther up there is a well-defined layer of more rarefied air. These conditions may be reproduced experimentally with the aid of a glass of water and a newspaper. Set the glass at the edge of a table, so that it may remain steady, place the newspaper at one side of it and your eye at the other, near the bottom of the glass. You will now see the printing through the water, and at the surface of the latter, reflected as in a mirror, an inverted image of the printing.

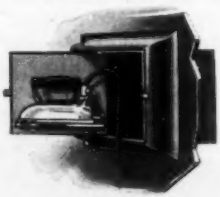
Double and multiple images are sometimes formed when there are several layers of air of different densities. Moreover, such contrasted layers sometimes form side by side, close to a sun-heated wall, for example, resulting in a "lateral mirage." Lastly, a mixture of air masses of different densities may produce the complex phenomenon of the Fata Morgana.

The traditional home of the Fata Morgana is the Sicilian shore of the Straits of Messina, as viewed from Reggio, on the opposite side. Many descriptions have been published of the phantom city, with its innumerable towers and palaces, seen at this place; but the phenomenon is actually very rare there and is more common in other parts of the world, especially in the polar regions.

There is one other delusive phenomenon connected with the horizon that has lately come into prominence because it is rather frequently observed from aircraft, whose pilots are sometimes deceived by it. This is known as the "dust horizon." It is a false horizon marking the upper boundary of a layer of dusty air, which, at times, extends to a height of hundreds or thousands of feet from the ground. Like mirage, the dust horizon furnishes a good illustration of the fact that the atmosphere has a strong tendency to form sharply defined strata—a fact that has a number of important meteorological consequences besides those described.

BUILT-IN CABINET FOR IRON REDUCES FIRE HAZARD

To keep the electric iron in a safe and convenient place, either when using it or when it is not in service, a built-in cabinet, lined with steel and asbestos paper, has been devised. The door is of aluminum and provides ventilation for the quick cooling of the iron. The cabinet is easily installed and is intended for placing near the ironing board so that the iron may be rested on the shelf.



WATER WALKING IS LATEST AUSTRIAN SPORT

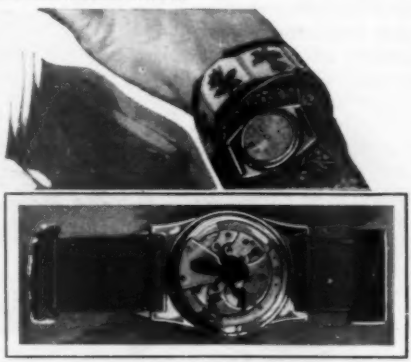
Members of the Water-Walking Club in Austria; They Hike from Town to Town along the Surface of the Danube River to Introduce the Novel Sport

Aided by two-bladed paddles, members of an Austrian club have been enjoying the sport of water walking from town to town along the Danube river. Their boat-like shoes are carefully shaped and balanced to assist the wearers in making speed with safety. The club has been introducing the sport at various centers and great interest has been aroused.

TOMATOES GUARD FLOWERS

The humble tomato plant, one of the most sensitive to poisonous gases, has become the guardian of more aristocratic blooms in conservatories and homes where cut flowers droop quickly and window-box gardens fail to respond to tenderest care. No chemical test can detect the small amount of gas required to kill flowers, but Dr. William Crocker, director of the Boyce Thompson institute for plant research, has found a healthy young tomato plant will give immediate warning. With only one part of gas to 200,000 of air the tomato plant grows faint and turns back its leaves. Carnations die when illuminating gas is present in only one part to 50,000 or even 80,000 parts of good air, and the canary, used in mines to guard against gas, can withstand from 25 to 200 times the lowest percentage that has proved injurious to delicate plants.

WRIST WATCH WINDS ITSELF WHILE BEING WORN



Self-Winding Wrist Watch in Wearing Position and with Case Opened to Show Works

Operating on somewhat the same principle as a pedometer, a wrist watch winds itself while it is being worn. This is accomplished by a weighted segment that moves on a pivot about the circumference of the works. It is said that wearing the watch for three hours, will wind it for a run of thirty hours.

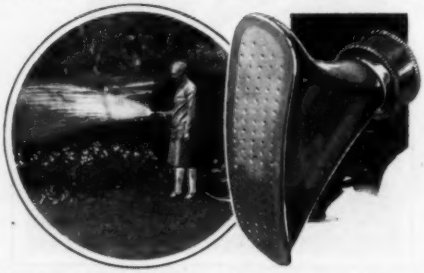
ing screen. The device may be obtained with a projector or separately and connected to the projector already installed.

According to reports, means have been developed for effectively eliminating the disturbances that ordinarily would be caused by the vibrations of the motor.

Recording Apparatus at Right; Reproducer Connected with the Movie Projector, and an Entertainer Who Makes Records

TALKING FILMS FOR THE HOME LATEST MOVIE NOVELTY

Talking movies for the home and school are now available with the introduction of a simple unit that drives a disk record in connection with the home projector, giving accurate synchronization of the pictures and the sound, it is said. The outfit resembles a miniature phonograph and its motor drives both the projector and the talkie unit, which is connected to the radio loud speaker. The speaker is placed near the screen for the best results in maintaining the illusion of the talk-



Fan-Shaped Spray from the Special Nozzle, and Close View of the Perforations

FAN-SHAPED SPRINKLER NOZZLE REDUCES WATER WASTE

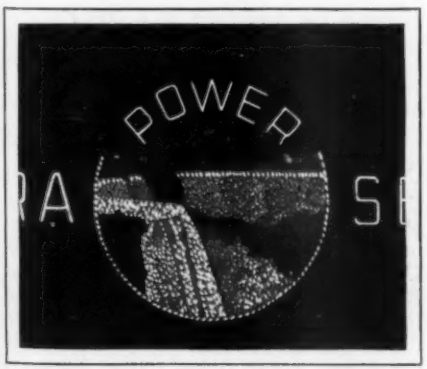
Being adapted especially for sprinkling flowers and delicate foliage, a recently introduced nozzle for the hose, spreads a flaring, fan-shaped spray of small drops. The water is held in a restricted area to reduce waste, and to prevent wetting adjacent territory, and the shape of the nozzle makes it easy to handle.

WHITE MINK ON FUR FARM

Animal authorities have been studying a white mink, captured three years ago in Louisiana and now at a Nebraska fur farm. So far as is known, this is the only specimen of its kind in the world and large sums have been offered for it. Fur raisers are speculating as to the possibility of crossing the mink with other species and thereby producing a variety that would have only white fur. The animal is valued at $10,000.

NIAGARA FALLS SIGN IN LIGHTS IMITATES WATER'S PLUNGE

Niagara Falls have been duplicated in a monster electric sign, recently erected near the great cataract. It cost $50,000, is 162 feet long and forty-five feet high. More than fifty tons of structural steel, five miles of wiring, hundreds of feet of neon-gas tubing, and 3,600 electric lamps were required for the installation. The sign's announcements are introduced by six flashes of golden "lightning," an effect obtained by lighting amber-colored neon tubes. Then the falls appear to spring into action, the mist at the base of the torrent and other features resembling those of the real cataract being secured by employing dimmers, colored bulbs and other apparatus. The letters of the sign itself next appear in characters, nine and ten feet high. The legend is considered an additional symbol of the mutual good will of the United States and Canada.



Niagara Falls Duplicated in Lights; Part of the Enormous Flashing Sign near the Cataract

Coin-In-Slot Apple Dispenser Which Distributes Several Varieties and Keeps Them All from Dust

COIN-IN-SLOT APPLE VENDER SUPPLIES DIFFERENT KINDS

Different varieties of apples are dispensed from a coin-in-the-slot machine which enables the customer to select the kind he wants. The fruit is kept free from dust and is in plain view.

RUBBER HEART KEEPS CAT ALIVE TO AID SCIENCE STUDIES

Successful tests with a rubber heart, operated by electricity, to pump blood though the circulatory system of a cat after its natural organ had been removed, are reported from Dalhousie University, Nova Scotia. The animal lived for hours with its substitute heart, giving investigators a better opportunity to study the effects of drugs and other substances on the specimen. Such research has been impeded in the past by the fact that the natural heart wears out and stops under the influence of the drugs before their full effects can be determined. Similar experiments with artificial hearts have been performed before, but this is said to have been the most successful to date and opens up a way for the more thorough investigation of various matters of interest.

The Fog Flying

With a Student Flying "Blind" beneath the Canvas Canopy Stretched over the Front Cockpit, the Instructor in the Open behind Him Is Ready to Take Over in an Emergency

VETERAN army flyers, heroes of many notable air adventures, proved themselves strangely helpless one afternoon not long ago in the clear air above Washington, D. C., and their endeavors to maintain their planes in level flight, furnished observers on the ground first amusement, and then alarm.

But unusually adverse wind conditions, engine trouble and faulty planes had nothing to do with the mysterious mishaps. They marked the start of a fog-flying school through which all officers on duty at the field were instructed to go for a period of several weeks.

An outgrowth of innumerable experiments based on the well-known fact that fog is one of the few hazards really feared by experienced airmen, the school's unique phase is the equipping of a Douglas observation ship with a cover on a framework that completely cuts off the pilot's view outside the plane. Unable to see sky or ground or anything beyond his cockpit, the pilot under the cover has to fly by instruments alone.

The idea of the class, and the design of the cover came from Capt. Ira C. Eaker, chief pilot on the record-breaking flight of the "Question Mark" last January. Under his supervision, army mechanics at Bolling field constructed a framework of four heavy wires from the windshield to the rear of the cockpit. Over these wires the canvas cover slides. Snap fasteners attach the edge inside the cockpit, and the

School

Maj. Howard C. Davidson, Commandant of Bolling Field, Ready to Take a Lesson in Blind Flying from Capt. Ira Eaker, Who Designed the Unique Apparatus Used

release mechanism is made instantaneous by the pulling of two wires, thereby enabling the pilot to emerge from "blind-flying" practice in case of emergency.

By a system of dual-control equipment the plane can be flown from either cockpit. In fact, the practice of the school, at all experimental "fog flights," has been to have a supervising pilot stationed in the rear cockpit who can take over the controls at a moment's notice if the student unwittingly throws the ship into a spin or drops dangerously near the ground. The rear pilot's job is also to note the course taken, so that the men will not lose their bearings with respect to the home landing field. Either pilot may take off the plane from the ground or land it, since it requires only a couple of seconds for the student to open the canvas cover to see his surroundings, and close it again.

Granted that the school fulfills the hopes of its backers, its substantial system may be included in the regulation training of all army pilots. As its very first student, the class had Maj. Howard C. Davidson, commandant of Bolling field, who made a half-hour fog flight. Next in order was Maj. Gen. James E. Fechet, chief of the army air corps.

"I never imagined a man could feel so absolutely helpless," Major Davidson commented following his attempt. "Nothing seems normal. Your senses tell you that a plane is in level flight when the instruments show it to be in a spin. After this experience, I can understand how it is that so many pilots have gone out of control in the fog."

Major Davidson pointed out that on his first blind effort, he made no attempt to hold the plane on a compass course, but tried merely to keep it level, depending on his bank-and-turn indicator to show whether he was in a climb or dive and his deviation from horizontal flight.

Captain Eaker voiced similar sentiments, adding: "Fog training should be a part of every pilot's instruction. A navigator who finds himself in a fog, and is unable to hold his ship in level flight and to follow a compass course, naturally is in a dangerous situation. On the other hand, if he is trained to fly by instruments, then he is afforded a large measure of protection and should be able to get out

One of the Chief Perils of Fog Flying; Overhead Wires into Which the Pilot May Crash While Flying Blind

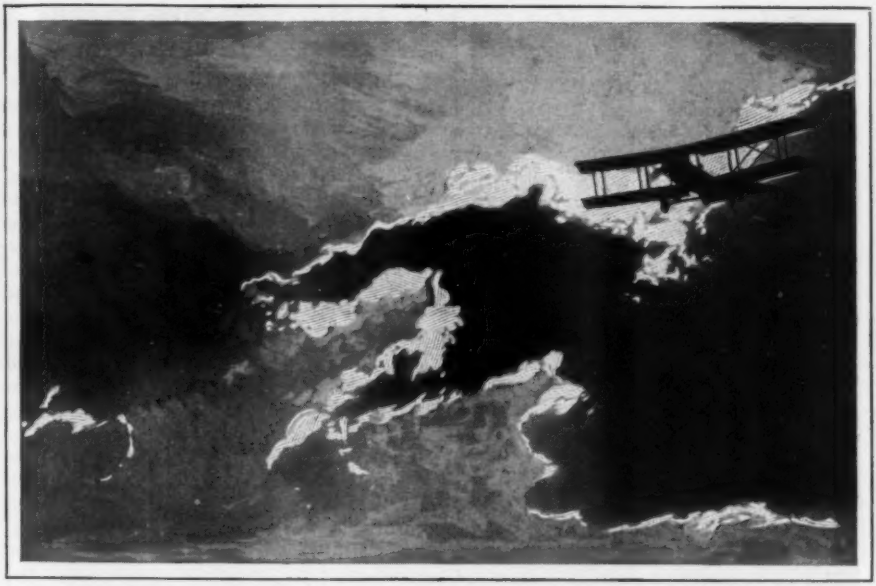
of the fog without wrecking his ship. There's plenty of talk about flying by instinct, but the really intelligent boys will tell you that's the bunk. Science, not guesswork, is the modern-day aviator's safeguard."

Other aviation experts are even more enthusiastic in their praise of the new system of training. First of all, they point out, they have found abundant evidence, during their dizzy zigzagging through the air while underneath the canvas cover, that, once a plane starts turning when there is no horizon or other visible object to guide them, the ship can go into spins or deep spirals with astonishing speed; and, even if these irregular maneuvers are recognized early, they often cannot be corrected quickly because of the natural confusion due to the effects of rotation.

Still other experienced flyers, to whom, normally, the idea of taking such elementary fog instruction would seem almost unnecessary, were amazed to learn that they had acquired certain habits of reacting to sensations that, in case of sudden encounters with fog or extreme darkness, might be terribly dangerous. In this regard, even their instruments play them false. For instance, if curved flight is involved and the plane is not level laterally, the compass becomes in part a dipping needle and might give incorrect indications. More specifically, on certain occasions when the pilot is heading north, instead of indicating a turning maneuver, the compass will tend to follow the head of the plane; whereas, on southerly headings, the needle has a habit of lagging behind the turn. Such conditions exist both in the case of magnetic and earth-inductor compasses. On the other hand, if the plane is not turning, a lateral inclinometer will indicate level correctly, and if the ship is leveled, the compass will indicate accurately, subject, of course, to deviation and variation.

The fog school has revealed some facts about the turn indicator hitherto only surmised by the experts. While this instrument revealed itself as the key device for avoiding spinning, and enabling a pilot under adverse conditions to maintain a fairly straight course, the other instruments, chiefly the air-speed meter and tachometer, played an important role in avoiding diving or descending at too high speed, or climbing at too high a rate and therefore stalling.

A curious contraption called the "fog disperser" has been the subject of numerous experiments at Bolling and other strategic fields of the army air corps. Two large hoppers were filled with about 700 pounds of sand and then attached to the fuselage in such fashion that they could be released into a thick bank of clouds or fog. The purpose was to see whether or not fog could be broken up, dissipated, or made to change position. The results



An Army Plane Racing an Approaching Thunderstorm; if Caught in the Clouds, the Pilot Will Have to Rely Entirely on His Instruments to Offset Mistakes in the Sense of Balance

weren't astonishing, by any means, but on one occasion it was noted that, when the entire tank of sand was discharged on an isolated cloud, about 4,000 feet in length and 2,000 feet wide, the cloud appeared to break up and vanish. Larger clouds were attacked, but it was found impossible to completely dissipate them. While, as yet, no practical results have been attained, it is expected that in time they will reveal valuable information about the fundamental structure of fog and clouds.

More important fog experiments are being conducted at the Wright experimental laboratories, at Dayton, Ohio, under the direction of Capt. Paul S. Edwards, chief of the radio section there. Having already developed the improved type of radio beacon, Captain Edwards is making experiments with "leader cables" and "marker beacons," which are designed to aid planes when they have arrived in the vicinity of their destination. Under present tentative plans, a leader cable would be laid in the direction of the prevailing wind, a few inches below the ground of the landing field. Radio waves, sent through the cable, would be picked up by the planes flying over the field, so they could determine the exact location of the field and the proper direction to take in order to make a safe landing.

To further aid the pilot in trying to land through a dense fog, "marker radio beacons" would be placed at strategic points along the leader cable. These beacons, through a standard set of radio signals, would direct the aviator to drop his plane to 200 feet at one point, to 150 feet at another, and to 100 feet a little later, and finally to a safe landing.

Still another key to the perplexing and dangerous problem may be derived from tests now going on throughout the country conducted by the Daniel Guggenheim foundation for the promotion of aviation. One aim is to develop low altimeters which would indicate the exact height of an airplane above the ground. Another purpose is to have expert flyers test fog conditions. Mr. Guggenheim said recently: "The solution of this problem, involving as it does the development of various devices, now the subject of intensive research in many countries, will do more than anything else to insure regularity and safety of commercial air transportation even in the most difficult weather."

Attaching Portable Phone to Wall Socket for Emergency Use; Many Houses Are Wired for This Service

PORTABLE PHONES PLUGGED IN WALL AID HOME SERVICE

Portable telephones that are plugged into specially wired sockets, in somewhat the same manner as electrical appliances are connected, have been introduced for the home. The plan simplifies the problem of having service wherever needed, helps save time and steps, and reduces the number of installations. The conduits are best placed when the house is built.

ORIGIN OF TERM "JOYSTICK" TRACED TO INVENTOR

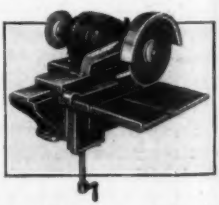
"Joystick" is the term given the world over to the control bar by which a pilot actuates the ailerons and flippers of an airplane and it originated from the name of its inventor, Joyee, a pioneer English aeronautical engineer. The stick method of control has remained practically unchanged since the early days of flying, but with the recent introduction of large planes and flying boats, the wheel control is coming into favor for these craft.

AERIAL EXPLORER TO SEEK POLE IN SUBMARINE

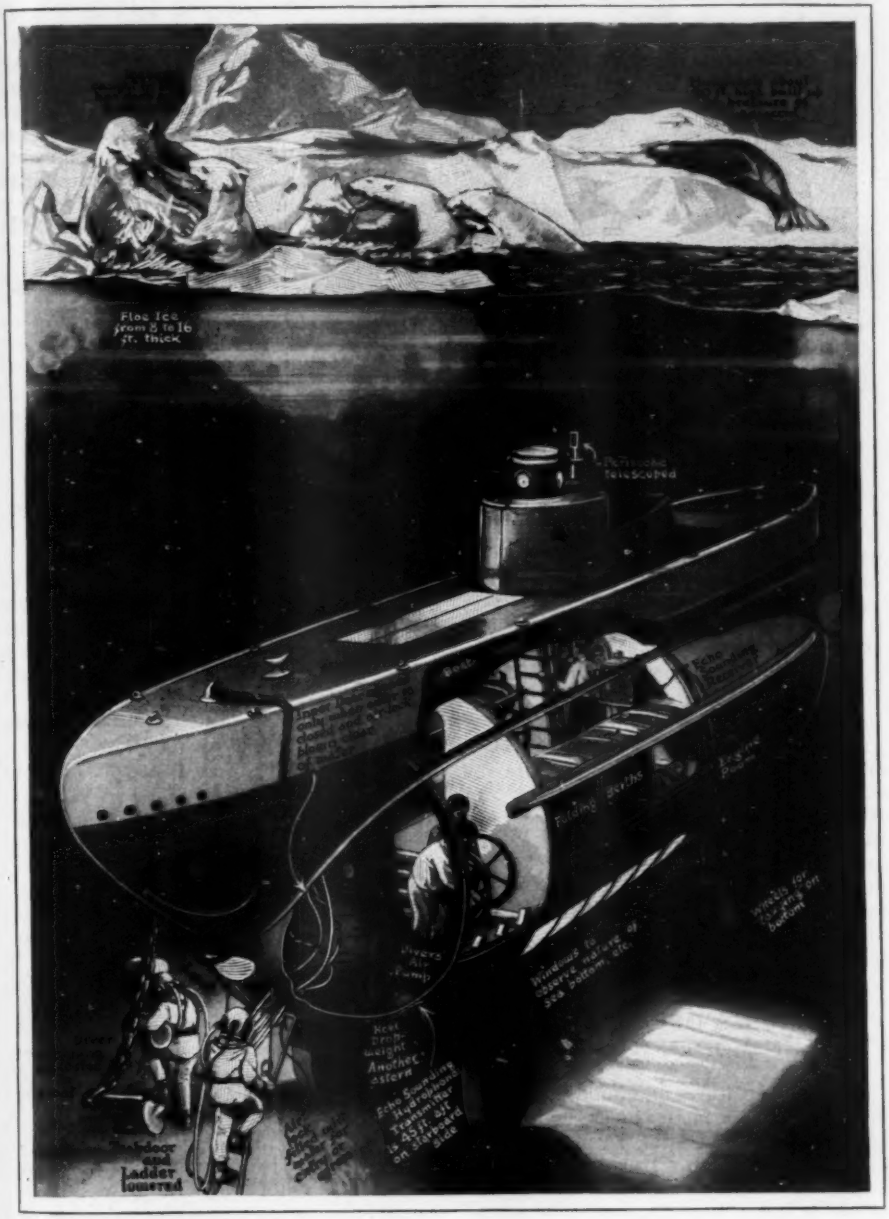
Sir Hubert Wilkins, back from an aerial exploration trip over part of the Antarctic continent, is planning to fill in his summer by invading the Arctic in a submarine. Peary walked to the pole and Byrd and Amundsen flew over it, while Wilkins last year crossed the Arctic from Point Barrow, Alaska, to Spitzbergen by plane, but, so far, a submarine has never attempted to invade the frozen seas. The plan is not so dangerous as might be thought, as the greater part of the arctic ocean is not by any means solidly covered with ice. Instead, the ice floes are interspersed with open leads, where a submarine could come to the surface, the distance between leads averaging not more than twenty-five miles. Submarines, in northern Europe, have come up through as much as eight inches of solid ice without trouble. The boat to be used is the little ninety-three foot "Defender," the world's only privately owned submarine. Built by Simon Lake in 1906, the "Defender" now belongs to Lake and his business partner, Capt. Sloan Dannehower, who will command a crew of ten volunteers on Wilkins' projected trip. A diver's escape hatch, fitted last winter under the bow in connection with submarine-rescue experiments, will enable the crew to walk on the bottom if the depth is not too great, and wheels also are being proposed to enable the sub to taxi when on the bottom.

CUTTER FASHIONS ODD TILE AT LOW COST

For shaping and trimming tile to be used in floors and for other purposes, a motor-driven cutter now on the market, has carborundum cutting and grinding wheels. A special gib is said to eliminate side play and to insure straight, clean cuts at all times, while it also is claimed to help prolong the life of the machine.



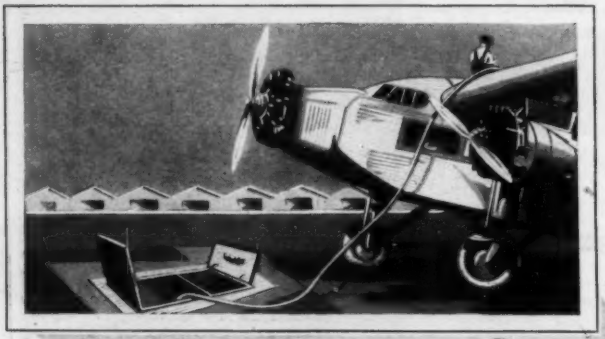
SUBMARINE TO HELP SOLVE POLAR MYSTERIES

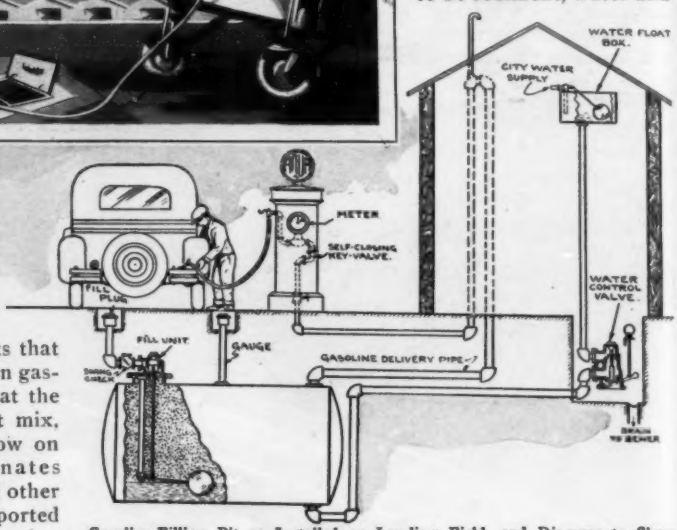

Floe Ice from 5 to 15 ft. thick
Periscope telescoped
Folding Berths
Windows to observe nature of sea bottom, etc.
Another Antenna
Echo Sounding Hydrophone Transmitter is ASH-can on Starboard side
Ladder lowered

Copyright, S. W. Clatworthy

Artist's Sketch of the Rebuilt Submarine "Defender," as It May Appear on the Bottom of the Arctic, If Sir Hubert Wilkins Carries Out His Exploration Plan

GAS IN PUMPLESS TANK FORCED OUT BY WATER





Gasoline-Filling Pit as Installed on Landing Field, and Diagram to Show How Water Forces the Fuel from the Supply Tank

Utilizing the facts that water is heavier than gasoline or oil and that the substances will not mix, a filling system, now on the market, eliminates the usual pump and other equipment with reported improvements in service, greater safety and other advantages. Briefly, water is let into the bottom of the gasoline storage tank and forces the lighter gasoline upward and out in a constant flow that can be measured accurately when wanted. There is no danger that water will be let into the containers, as the outlet is automatically shut off when the water level is within six inches of the top of the tank. A better grade of gasoline is obtained with this system, it is claimed, than with the usual pumping outfit which draws it supply from the bottom of the tank where there is likely to be sediment, water and an inferior quality of gasoline, since the best is the lightest and therefore rises to the top. As the tank is always full of liquid, there is no danger of fire or explosion and there is less chance of any equipment getting out of order. The system can be adapted to a wide variety of installations and is reported to have given satisfactory service wherever it is in use.

MANY USES OF TILE SHOWN IN MODEL HOUSE

One of the features of a building exhibit in Detroit was a model house which had been designed and built 300 miles away, transported in motor trucks and set up inside a hotel, to illustrate the many uses of tile in home construction. The material was employed as door and window trimming, for floors and walls, and for special fixtures in the bathroom, such as built-in soap dishes, towel racks and electric-light brackets. The outside of the house was of stucco with tile plaques used at various spots for decorative effect.

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

TINY WINDMILLS SERVE AS EYES TO GUIDE BLIND FARMER

Small windmills serve as eyes to direct Kary McCauley, Michigan farmer, about his farm, and even along a two-mile highway to town, since he became blind three years ago. The tiny windmills have been placed at strategic points about the farm and along the highway. The wind sets them in motion and by the rattle the blind man is guided from one mill to the next. On the infrequent days when there is no wind to rattle the vanes, he guides himself from one building to another by means of wires stretched between them. When the farmer's eyesight was failing, an old horse helped direct him, but about the time he became blind the horse died, and the farmer resorted to the windmills.

DISPLAY PHOTOS IN MOTION IN NOVEL SHOWCASE

An effective way to display photographs in his showcase has been devised by an eastern photographer. The case has four revolving frames, which may be turned by hand, using a knob at the side, or by a small electric motor. It is mounted on casters for easy moving to any part of the room, and has a shelf for an electric light.

Racks on Upper Portion of This Photo-Display Cabinet Revolve, Increasing Effectiveness of the Showing

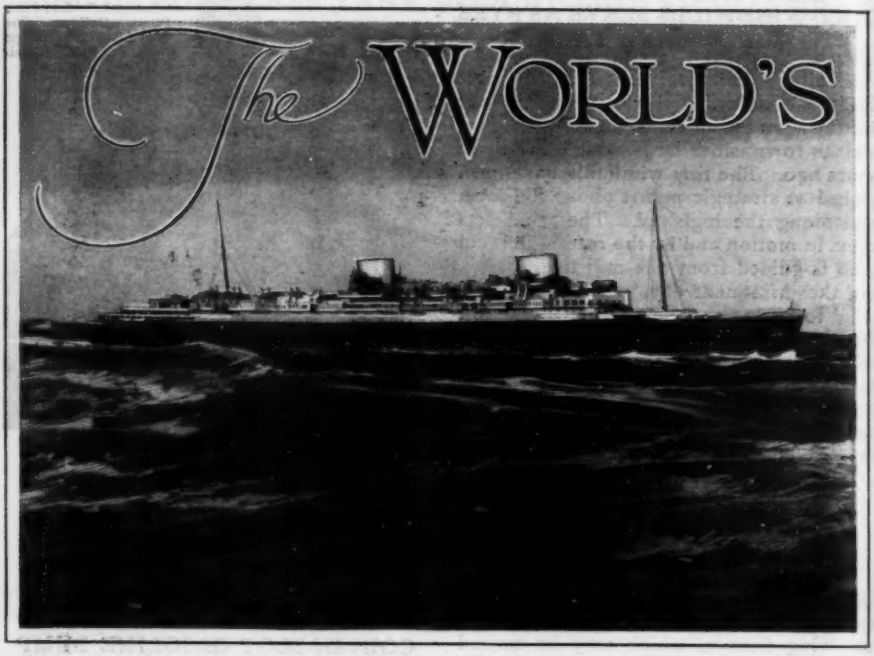
"Cafeteria" Service Pump Delivers Gas When Motorist Drops Coin in Slot, Eliminating Attendant

COIN-IN-SLOT GASOLINE PUMP SAVES MOTORIST TROUBLE

Motorists arriving at filling stations only to find the attendant gone may take advantage of a "cafeteria" service pump operated by inserting a fifty-cent piece in a slot. The half dollar, striking an electromagnet coil, releases a quantity of gasoline corresponding to current rates. The pump refills automatically and is ready for the next customer.

LIGHTS UNDER SWIMMING POOL PROTECT BATHERS

Underwater illumination of swimming pools has been found to promote both safety and hygiene, as well as add to the attractiveness of the pool by the various lighting effects. Swimmers in a pool with both submerged and overhead lights are continuously in the sight of guards, even when under water. The lighting also shows clearly defects in the performance of filters or want of cleanliness. Projectors are placed behind glass plates in the walls or floors of the pools and a variety of lighting effects is possible by using diffusing or colored lenses.



Introducing the Latest Challenger for Ocean Speed Records among Large Passenger Vessels, the 46,000-Ton "Bremen". Scheduled for Five-Day Service between New York and Channel Ports

WHEN the new express liner "Bremen" glides from the harbor of Bremerhaven this summer and her bow is turned westward for the six-day trip to New York, the world will witness the first skirmish in a titanic struggle for supremacy on the sea. It will be a long and hard-fought battle; its results rest in the future—and in the hands of shipbuilders and the designers of aircraft.

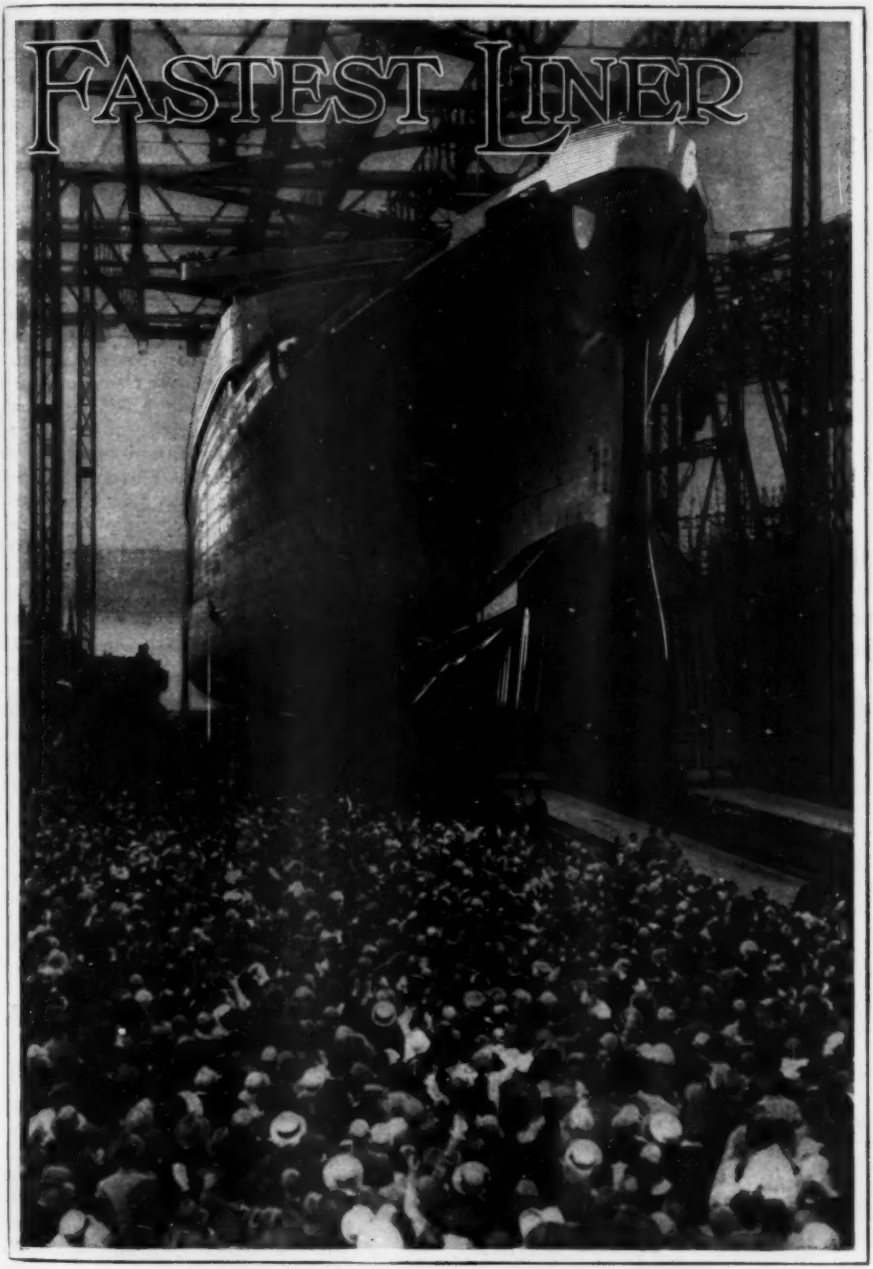
The "Bremen" and her sister ship, the "Europa," were launched last summer under the star-and-anchor house flag of the North German Lloyd lines. The "Europa," whose original sailing date was set for early this summer, was badly damaged by a fire which swept the upper decks while she was under construction and caused her owners to postpone the maiden voyage until early in 1930.

Both are giants, and stand fourth in rank of size among the great ships plying the Atlantic. With a tonnage of 46,000, their long decks stretch 920 feet from stem to stern. In their four classes there will be accommodations for 2,000 passengers in quarters setting new standards in ocean travel, and a crew of 950—the cream of the Lloyd's veteran seamen—will man each.

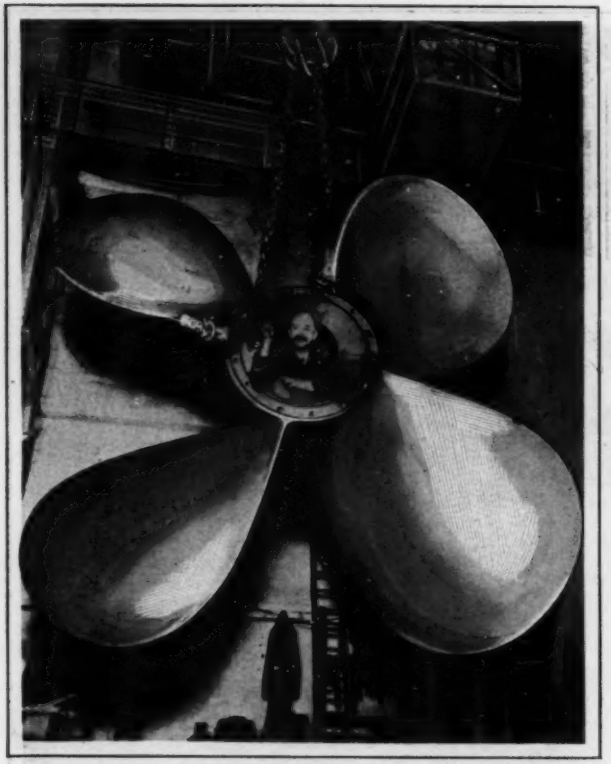
The speed of these new vessels will not be definitely known until the maiden trips. Officials of the Lloyd have kept details of the engine design of the sister ships secret. They have, however, announced them as five-day ships—the first Atlantic vessels ever to be placed on that schedule. These two liners will make a bid for the speed record across the Atlantic now held, as it has been for over twenty years, by the "Mauretania."

Despite marvelous innovations in ocean transportation in the last thirty-five years —the installation of private baths and other luxuries, the introduction of turbines, the discovery of radio communication, the invention of devices for detecting icebergs—there has been practically no increase during the period in the speed of vessels.

The "Etruria" made the voyage from Liverpool to New York in three hours un-



Scene at the Launching of the "Europa," Sister Ship of the "Bremen" and Later Damaged by Fire That Prevented an Early Voyage; Note the Odd Shape of the Hull, Intended to Reduce Wave-Making Resistance



One of the Four Huge Propellers of the "Europa"; It Weighs Over Seventeen Tons; Propellers for Both Ships Were Made in England

der six days. That was in 1892. Later the "Campania" cut transatlantic time to five and a half days on a trip from Queenstown to New York. The "Mauretania," holder of the speed record from 1907 to the present time, has made the journey in slightly less than five days. She is, however, a six-day ship, and that is her normal time for crossing.

These new North German Lloyd vessels are scheduled to make the crossing from the Channel ports in five days—120 hours—and the trip from Bremen in six—a scheduled time below that of any passenger ship afloat. What they will be able to do to beat the "Mauretania's" record is a mystery, but rumors on good authority place the speed of the sisters at not less than twenty-seven and a half knots (thirty-three and two-thirds land miles an hour). With this average speed, it is not improbable that a four-day crossing of the Atlantic will be nothing unusual in the future. The placing of 46,000-ton liners on such a schedule is more unusual when one remembers that the "Mauretania" is a boat of only 30,000 tons, "built like a yacht."

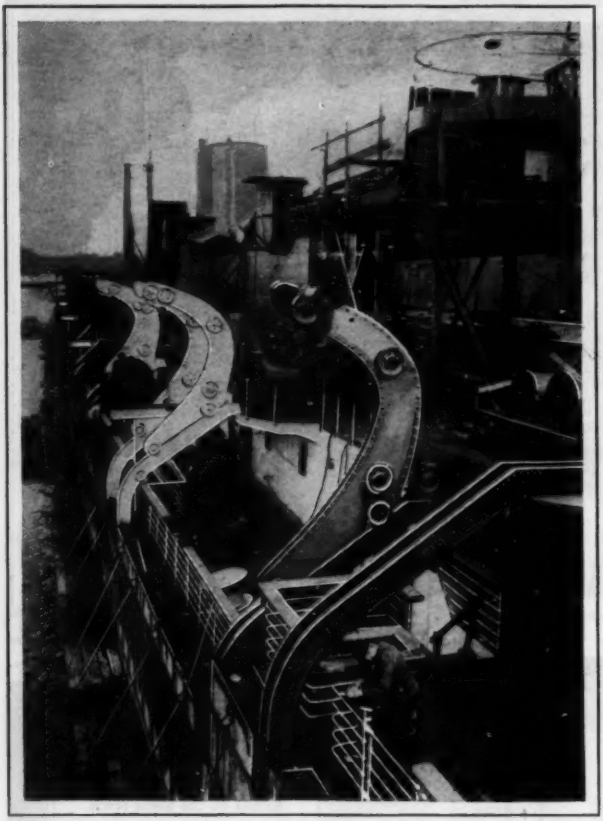
Thirty engineers supervise the propelling machinery of each ship, consisting of high, medium and low-pressure turbines, working in two separate engine rooms and driving four seventeen-ton bronze propellers. The steam used for power is condensed by a cooling apparatus which calls for 32,000 tons of sea water per hour. The plants supplying the ships with electric power are as large as the power house of the famous university city of Heidelberg. Signal bells and telephones, also operated by the power plant, are located at 10,000 points in each ship.

To cut the time for express mail, an airplane on the sun deck of the ships will be catapulted for a speedy trip with mail when the liners are 1,000 kilometers (about 620 miles) from shore.

Supplies for this ship's population of 3,000 persons are taken on at Bremen, and include the following items for each trip: 100,000 pounds of meat, 30,000 pounds of fish, 35,000 pounds of fowl, 10,000 pounds of bread, and 45,000 pounds of flour for bread and pastry to be baked in the electric ovens, 4,300 pounds of coffee, 300 of tea and 600 of chocolate. There will be 17,500 quarts of milk, 2,000 quarts of cream, 15,000 pounds of butter and 2,000 of lard.

In addition to setting a new record for speed, the "Bremen" and the "Europa" are also expected to surpass any of the previous ventures in "luxury asea." Every

Glimpses of the Luxurious Accommodations on the New Liners, the Interiors of Which Resemble Palatial Hotels; There Are Exclusive Shops, Gymnasiums and Other Play Rooms, While a Special Feature of the Latest German Vessels Is the Night Club; This Is Placed in a Secluded Position on an Upper Deck, Where the Noise Will Not Disturb Other Passengers; Another Feature Is the Placing of All the Dining Salons on the Same Deck



Scene on Board the "Bremen" Just before Its Completion; the Ship Is 920 Feet Long and Will Carry 2,000 Passengers besides the Crew

stateroom, from third class up to first, has hot and cold running water. The first-class cabins all have private toilet facilities, 180 have individual baths, and 100 are fitted out with showers.

Sports will have their share in the daily life of the passenger who takes the new ships. There is the tiled swimming tank supplied with chemically purified water, which is kept at a set temperature by heating equipment, and medicinal baths. There is the gymnasium with ample space for floor games, an indoor golf course, a shooting gallery, and bowling alleys for those whose athletic pursuits take a milder form.

Among the rows of smart shops on the vessels one finds the barber shop, the tailor's rooms, and a fully equipped beauty shop for fair passengers. For the children (many of whom now travel alone across the ocean) one finds a large airy play room under the direction of an experienced nurse and governess. Each ship's physician has a miniature hospital fitted out to care for major operations, if the need arises on the floating city with its population of 3,000.

An innovation on German ships is the restricted night club. The cabaret, which has to a large extent accounted for the popularity of the French liners in the past, was adopted for the new ships by its owners who had in mind American passengers. Remembering, however, that many passengers object to the sound of music and laughter in the early hours of the morning, the night club was placed on an upper deck in a secluded position to keep noise from reaching the cabin rooms. A battery of swift-moving elevators carry passengers from one to another of the ten decks. An innovation in steamship design was the placing of all dining salons on the same deck.

So the race for supremacy in speed on the Atlantic begins with two giant liners facing the dirigibles and planes of the future. But the sailing of the "Bremen" is more than a skirmish in the fight between air and water. It marks the beginning of an intensely dramatic struggle for control of the rapidly growing passenger traffic between the United States and Europe. It marks the comeback of Germany as a formidable competitor in the race in which the United States, England and France are now leading.

¶Tin is the only important metal not mined in the United States.

"FORGOTTEN" CITY CUT IN ROCK IS MARVEL OF ART

Built in a deep valley below the level of the surrounding country, the city of Petra, on the Sinai peninsula, contains a number of architectural features that show the skill of its ancient craftsmen. Among them is the so-called "treasury of Pharaoh," with a central door nearly thirty feet in height, which leads to three unornamented chambers cut into the solid rock. The central dome is the fabled repository of the treasuries of some of the Pharaohs. Another building is known as the monastery, and is supposed to have been used as a Christian church. Like the treasury, it is carved out of solid rock. The city is believed to have been built shortly before the Christian era and was a sort of "melting pot" of the ancient world. It enjoyed a favorable location on the trade routes between Greece and Rome, Arabia and Persia. The Romans constructed military roads to it when it was an outpost of the empire. After the fall of Rome, it was abandoned, but was rediscovered early in the last century.

Entrance to the "Treasury of Pharaoh," One of the Carved-Stone Wonders of the City of Petra

ADJUSTABLE-FENCE MITER BOX INSURES GREATER ACCURACY

Saw frame and fence are both adjustable in a compact and improved miter box now on the market. It weighs but fourteen pounds, is collapsible and easily carried in a small container. The adjustable fence permits cutting at any angle desired and, with the saw frame, is alined with the aid of a T-square which is part of the outfit. Greater accuracy as well as increased performance is one of the chief features claimed for the box.

WHISTLING GOLF CLUB TELLS WHEN SWING IS PERFECT

Golfers now may determine whether their swing is imperfect by listening to a golf club which whistles when the drive is made properly. The device is a driver with a hollow metal head having a hole in the bottom. If the golfer does not hold the club with the head facing the ball squarely, or fails to follow through when he swings, the driver will not whistle.

HOW MODELS HELP MAKE BIG MOVIE SPECTACLES

The Advance in Trick Photography and in Model Making Is Saving Movie Magnates Hundreds of Thousands of Dollars and Enabling the Presentation of Mammoth Scenes That Otherwise Would Be Impossible; the Top Picture Shows a Scene from a German Film, and the Bottom One Some of the Workmen Putting the Parts in Place; Despite Its Small Scale, the Model Is a Huge Affair

MACHINE BLOWS FRUIT FREE OF ROT WHILE HANGING ON TREE

Jacket rot, which causes heavy losses to fruit growers annually, is being attacked by a California orchardist with a blowing machine operated on the fruit hanging on the trees to clean it of rotting calyxes. The device consists of a 125-horsepower engine coupled to a blower. The engine operates a steel fanwheel which delivers a blast of air through a canvas sleeve at the rate of 20,000 cubic feet per minute. The apparatus is mounted on a cart drawn by a tractor. By playing the sleeve up and down the tree and from different angles, the operator cleans the fruit.

SHIELD KEEPS TERMITES FROM BORING WAY INTO HOUSE

To prevent termites, the destructive insects that devour wood, from entering homes, University of California engineers have devised a metal shield to be placed on top of the concrete foundation immediately under the wooden sill that rests upon it. The shield hangs over both sides and is so shaped that the termites are not likely to build exterior tunnels around it, and thus gain entrance. Simple concrete or other non-wooden foundations have been found ineffective, unless protected in some such way as this, for the insects build up covered passageways and so travel up the concrete in their search for wood. Extensive damage is done in many sections by these persistent pests that literally reduce wood to an empty shell without any apparent damage to the exterior.

Most women's shoes have wooden heels.

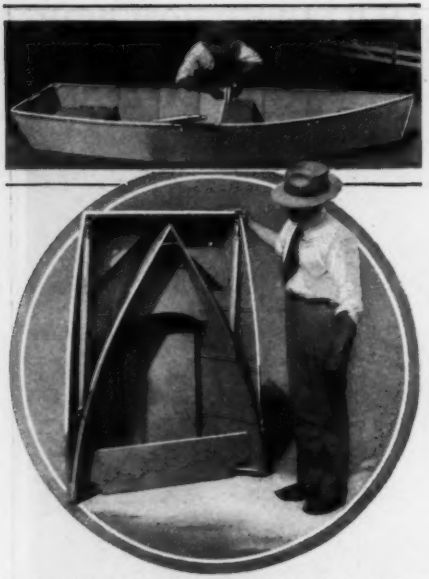
English Barge Equipped with Detachable Outboard Engine Which Is Replacing the Slower Barge Horse

OUTBOARD ENGINE FOR BARGES REPLACES SLOWER HORSE

Plodding barge horses in England may go the way of their carriage mates. A barge equipped with a detachable outboard gasoline engine has made a trial trip of 147 miles from Birmingham to London in fifty hours, far outdistancing the animal that walked along the river bank pulling the barge by a towline.

GASOLINE FROM LIGNITE

High-grade motor gasoline and numerous by-products are to be extracted from lignite coal in a plant to be constructed near Frederick, Colo., where such coal is plentiful. The plant, consuming 500 tons of coal a day, will utilize processes developed in Germany and Great Britain to recover not only the gasoline, but motor oil, creosote and other by-products. The residue of the coal will be bricked for fuel.



Boat Collapsed and Assembled; It Is Made of Steel and Shaped for an Outboard Motor

PORTABLE TWO-SECTION BOAT IS MADE OF STEEL

Consisting of two sections that are quickly joined together, a portable steel boat, designed by a western man, is easily transported by auto for camping and fishing trips. It is safe and light in weight, yet strong and well adapted for the use of an outboard motor.

PRINTING BY VOICE ACHIEVED BY TALKIE-TYPESETTER

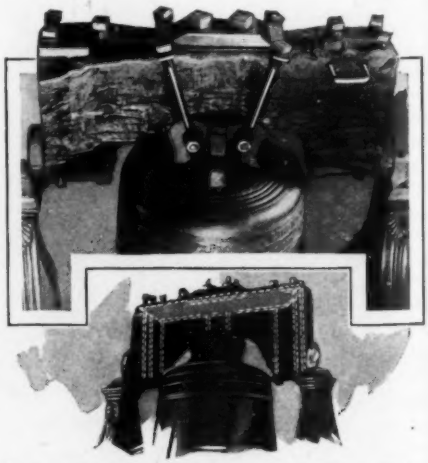
Substituting the human voice and a roll of movie film for the linotype is the object of the talkie-typesetter, development of which has been announced. A working model intended to further eliminate the human element in printing, is now in operation. Copy is read into the machine, each word being spelled out, and the voice is recorded on the moving reel in the type font which has been adjusted to the particular type face wanted. Disks similar to those used in dictating machines also may be run off in the device, enabling the reporter to read his own story into the disk. Heads and subheads are read with the story and type is adjusted to fit them. Separate pieces of film, containing the type of each paragraph, head and subhead, are laid on a page form and a zinc plate is made of the page. Wire installation, similar to that used in talking-picture studios, is a part of the apparatus.

BRICK PRESSED FROM PAPER RESIST FIRE AND WATER

Paper is the chief ingredient in a fire and waterproof brick that a Serbian sculptor has prepared. It is suitable for the construction of one and two-story buildings, according to reports, and nails can be driven into it without damage. Buckets, car wheels and many other serviceable articles are being manufactured from paper.

STEEL BRACES ON LIBERTY BELL TO PRESERVE YOKE

Reinforcing castings of steel have been inserted into the wooden yoke of the Liberty bell to help preserve the priceless relic. The bars are concealed and only the plates and nuts at the top and bottom of the yoke indicate the "operation" that has been performed on the 176-year-old timbers, to prevent their collapsing. The steel bars will support a weight of 10,000 pounds. The Liberty bell itself weighs but 2,080 pounds.



A Steel Backbone for the Liberty-Bell Yoke; Photo-Diagram Below Shows Where Braces Are Installed

A Five Million Volt Flash

Millionth-of-a-Second Camera, Used in Taking Photographs of Lightning Flashes

A MODERN Jove is Frank W. Peek, Jr., whose recent spectacular achievements in the mastery of lightning problems have created a profound stir and gained him the distinction of being one of the world's outstanding authorities on this subject.

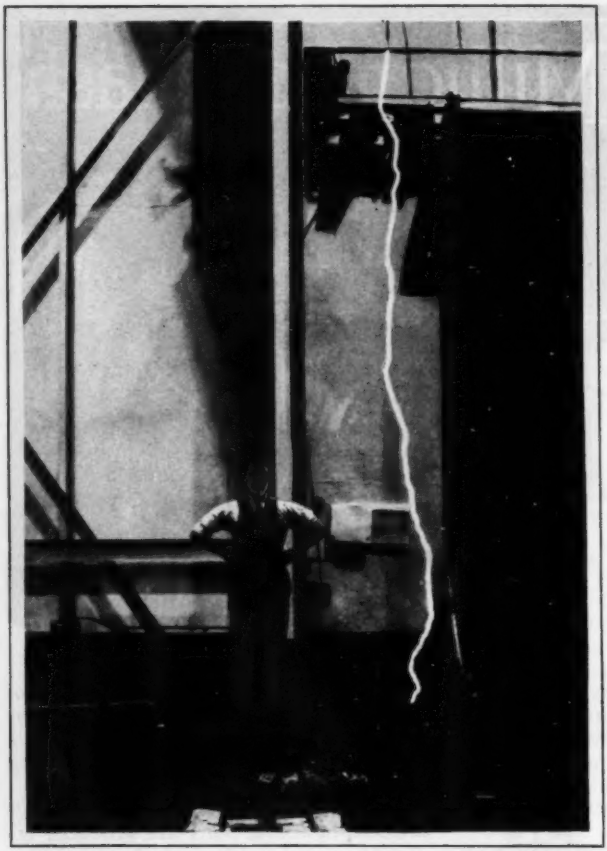
This modest, unassuming electrical engineer actually forges 5,000,000-volt bolts of lightning, makes them sit for their photographs, takes fingerprints of them, shoots them at objects which he wishes to destroy, or at apparatus which he wants to test as to its resistance to natural lightning, and otherwise juggles them and toys with them at will.

As long ago as 1923, he was carrying on extensive research work with voltages up to 2,000,000, high enough to make the layman shudder and to cause the electrical world to sit up and take notice. But in 1927 he became dissatisfied with such a "weak" plaything. It did not serve his purpose adequately, and he applied himself to the problem of developing a new type of artificial-lightning generator, with which he succeeded in obtaining discharges of 3,600,000 volts about a year ago. And now he has reached a new pinnacle of achievement by creating 5,000,000 volts of man-made lightning.

That is the maximum voltage directly generated, but by applying it to a transmission line, 10,000,000 volts, or one-tenth the voltage of natural lightning, has been measured, the result, Mr. Peek explained, of reflection, and consequent doubling, of the 5,000,000-volt impulse on reaching the end of the line. In this respect the voltage might be likened to a water wave striking a wall and doubling back on itself.

The laboratory where the 5,000,000-volt artificial-lightning bolts are produced resembles a mammoth vault, being eighty-two feet wide, 121 feet long and sixty feet high. The lightning region is surrounded by a high iron fence, designed to hold the power within bounds, and during the experiments, the steel window shutters are closed and the electric lights turned off, making the place black as pitch, except when it is illuminated by the lightning flashes.

Your ear catches the sound of a low hum that rapidly grows louder as the generators are being charged, you see a flash of intense blue between two shining brass spheres, and then hear a quick, tremendous hissing crash. You feel the hair on the back of your hand bristle during an instant of silence, and then, back from the surrounding walls, the rolling thunder echoes and re-echoes. Meanwhile you per-



Five Million Volts Represented in a Flash of Artificial Lightning; a Double-Exposure Photograph; the Man Was Not Present as the Flash Jumped

ceive a strong smell of ozone in the air, and you make up your mind to get out of there as quickly as possible. However, Mr. Peek assures you, there is really no danger of being struck.

But how was the 5,000,000-volt artificial-lightning bolt produced, you wonder.

To obtain this enormous voltage, now being studied by Peek and his associates in the Pittsfield, Mass., high-voltage laboratory of the General Electric company, he devised a radically new method of linking up generating units. This method, he explained, involves the use of four 1,250,000-volt generators in series, so arranged that the voltages of all the generators are added at the proper instant.

Alternating-current voltage is applied directly to each unit generator, without use of rectifiers, and, at that instant on the crest of the wave when each unit is charged to capacity, gap spark-overs take place, connecting the generators in series and permitting the discharge to occur.

But you may be wondering how the study of lightning can be of any practical value anyway, and what Mr. Peek is going to do with 5,000,000 volts of artificial lightning now that he has it.

"Michael Faraday, great English scientist, once gave a perfect answer to that," he laughed.

"Faraday was lecturing one day upon some new scientific discovery or other, which, to at least one woman among his listeners, seemed of no practical value.

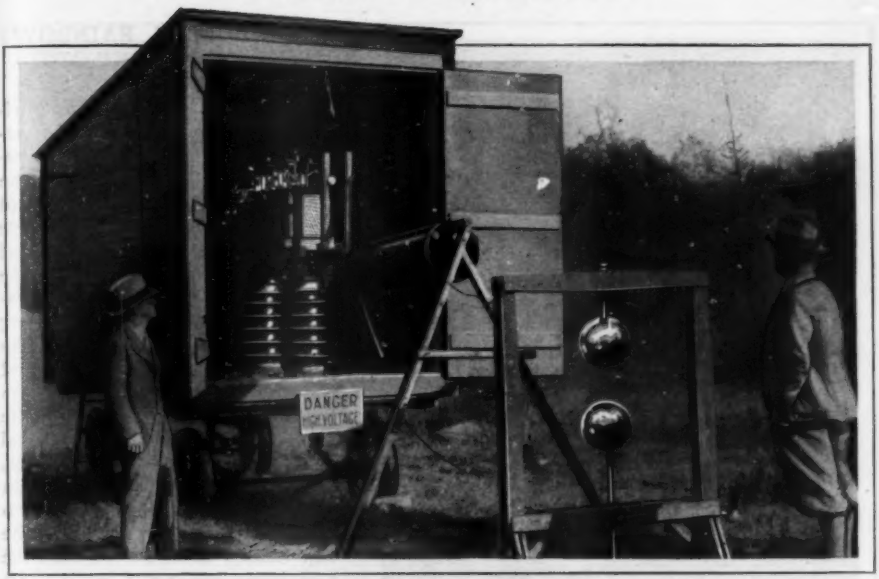
"'Mr. Faraday, what's the good of all this?' she demanded, when he had finished. And quick as a flash Faraday replied:

"'Madam, what is the good of a new-born baby?'"

For the new-born babe may mean nothing to the world. But, on the other hand, he might become a new Galileo, a Newton, a Volta, or an Edison.

And the new-born baby of the lightning laboratory, with a 5,000,000-volt punch, is destined to play an important role in the development of electrical engineering, Mr. Peek predicts.

"With the increased voltage now available in the laboratory, it becomes possible for electrical engineers to approximate more closely the effects of natural lightning," he stated. "And while we realize, of course, that we still have a lot to learn about lightning, we may now say that at least it is on an engineering basis. In other words, it is no longer in the realm of the 'medicine man.'



Portable Impulse Generator for Applying Surge Voltage to Transmission Lines, Part of the Equipment Used in Studying Effect of Lightning Striking Wires

"Every once in a while somebody asks me if I'm trying to find out how to harness natural lightning and utilize it's energy," he went on. "But that wouldn't pay. What we are really trying to do is rob it of its destructive power, or tame it, in other words.

"Lightning is an unorderly, predatory form of electricity, dangerous not because of its enormous energy, but because of its enormous power and 'flighty' habits.

"The distinction between energy and power is that energy is measured in kilowatt-seconds or kilowatt-hours, while power is measured in kilowatts. Kilowatts measure the rate at which work is being done.

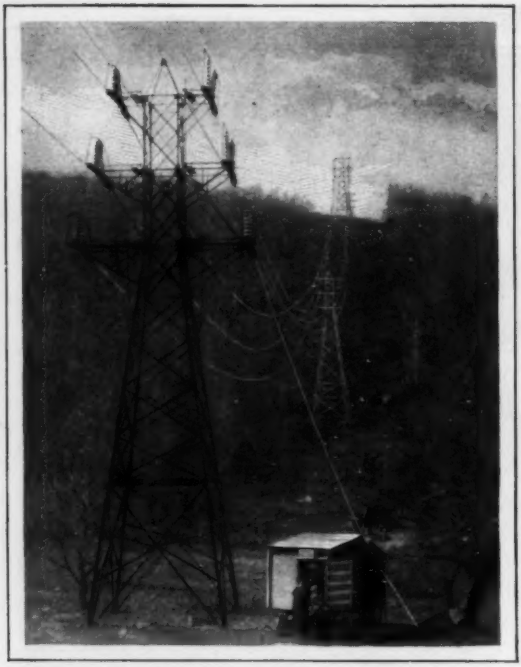
"To give you a concrete example; if all the energy of a severe lightning stroke could be put into a storage battery, it would carry an electric automobile about five miles or operate an electric iron for only a day. But since this energy is dissipated in a few millionths of a second in a limited space, the effect is a terrific explosion, and the power is millions of kilowatts, though the kilowatt-seconds or hours are small.

"Study of lightning is of considerable practical engineering importance because an exact knowledge of its characteristics will make it possible to protect human life, homes and other buildings, powder magazines, gasoline and oil tanks, high chimneys, transmission lines and all electrical apparatus against it. Also it is of scientific importance because there is manifest in the flash the dynamic effect of the electrons and ions, the elemental bricks of which it is believed all matter is made.

"The best way to make such a study is by observation of natural lightning in the field and artificial lightning in the laboratory. By means of artificial lightning, knowledge can be gained in a few months that would take years to gain in the field, because laboratory discharges can be repeated as desired, while it may be necessary to wait years for a natural discharge at any given place.

"The lightning generator has been of considerable value in gaining a knowledge of natural lightning. It has afforded a means of finding the best insulations to withstand lightning, as well as the best way to design transformers, insulators and lightning arresters.

"Incidentally, the protection of buildings by lightning rods has been investigated, and it has been determined that the



Applying Surges on Transmission Line near Pittsfield, Mass., in Studying the Effects of High Voltage

lightning rod is of real value in preventing or limiting damage when a building is struck.

"The fields in which the new high voltage will be employed experimentally are yet to be determined," Mr. Peek continued, "but it will be used in the further research being conducted in the study of natural lightning, its effects on electrical generating and transmission apparatus, and ways of protecting such apparatus from damage by lightning.

"In the early days of electricity generating stations often were crippled during thunderstorms, and most houses had combination gas and electric fixtures, and possibly also a supply of oil lamps and candles, for emergencies.

"But such provisions are hardly necessary today, for engineering investigations have shown how to build lightning arresters that will protect equipment against surges by lightning. And the work that is being carried on today is bringing nearer that day when interruptions will be even more infrequent."

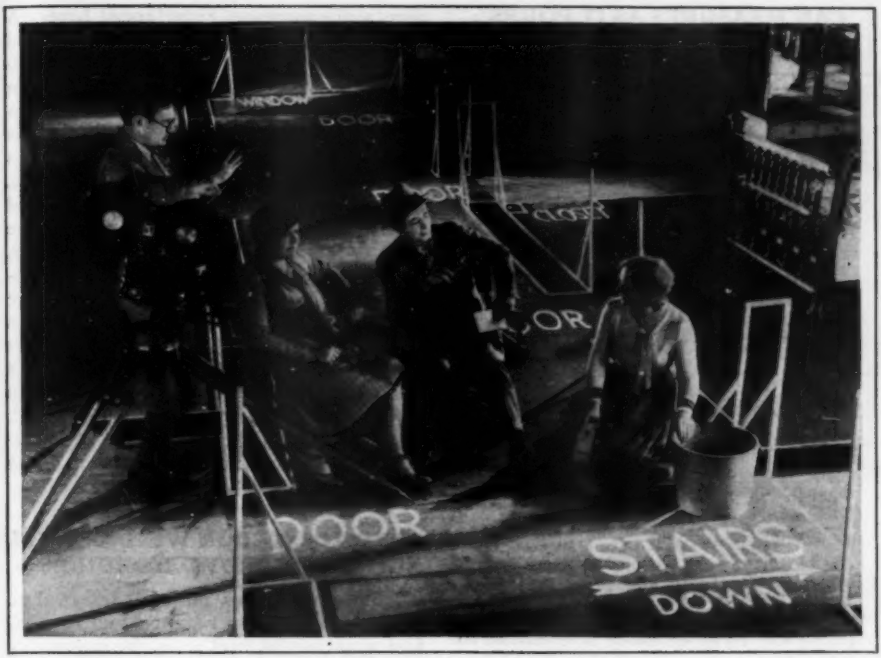
HORIZONTAL RAINBOW EXPLAINED BY OIL

Rainbows that seem to lie horizontally upon the surface of water are occasionally seen, sometimes in clusters, one behind the other. Dr. W. J. Humphreys, of the weather bureau, explains these phenomena are due to a layer of small drops that are resting on the surface of the main body of water but prevented from merging into it by a thin film of oil. The sun is back of the observer and the rays of light are refracted to his eyes by the tiny drops. If the sun is overhead, the horizontal bow appears as a circle. If lower, the bow takes the form of an ellipse. At an angle of forty-two degrees above the horizon, the sun causes the bow to describe a parabola, while at a lower angle of the sun, it is a hyperbola. The cluster of several bows, seen only rarely, is formed by reflections from the actual surface of the water, as the sheet of droplets may not be quite in contact with the water surface. These peculiar bows are most generally seen following a fog.

PHONE NICHE OF TILE MATERIAL HELPS SAVE SPACE

Telephones are kept neatly out of the way, but in convenient position for use, by installing them in niches cut into the wall. A unit made of a tilelike substance, is artistically decorated and has space for the directory as well as the instrument stand and the bell-box container. Each niche is a complete unit and is installed simply by cutting a hole in the wall. The material is furnished in polychrome tints.

¶Amber is pine-tree resin in fossil form.



Rehearsing a Part for the Talkies on a Skeleton Set, Which Has Been Developed to Remove from the Expensive Sound Stage the Long Periods Given to Rehearsals

CHALK MARKS ON FLOOR CUT COST OF TALKIES

Skeleton sets for the rehearsal of parts in talking pictures have been developed in Hollywood, to allow the permanent sound stage to be given over entirely to the current production, thus reducing overhead expense involved in turning the sound stage over to rehearsals. The skeleton stage, in general outline, is similar to the permanent stage, but doors, windows, stairways and furniture are simply indicated by chalk lines on the floors.

SAFER X-RAY FILMS TO REDUCE EXPLOSION HAZARDS

Less inflammable X-ray films and better methods of storing them are seen as some of the immediate results of the recent hospital disaster in Cleveland, where many persons were killed by inhaling poison gases given off from burning films. Carbon monoxide, the colorless, odorless gas given off by the exhaust from auto engines, and nitrogen oxide, were at least two of the gases chiefly responsible for the deaths in the Cleveland tragedy, according to explosive experts. The brownish color of the fumes was due to the presence of the nitrogen oxide. The films that exploded were chiefly of a cellulose-nitrate variety. This material contains relatively large quantities of carbon and produces volumes of carbon monoxide when it burns under insufficient supply of air. Nitrate films, if confined and allowed to grow old, are liable to spontaneous combustion. The stock of such film is the same substance as smokeless powder, sticks of which can be burned without an explosion if only small quantities are used and in the open air. Films made of a cellulose-acetate base are slow-burning and difficult to ignite.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago. Send no stamps; the service is free.

CAN MEASURES AS IT POURS TO MAKE BETTER COFFEE

Drawings Showing Coffee Container That Measures Out Proper Quantity to Use in Percolator

Using the right quantity is essential to good coffee making, and this detail has been simplified by means of a can that measures as it pours. By using one side of the spout, a tablespoonful is obtained, and from the other side, a teaspoonful. It is not necessary to remove the lid of the can except for refilling, and as a consequence the coffee will be kept in better condition.

MARS IS FOUND BEYOND REACH OF RADIO MESSAGES

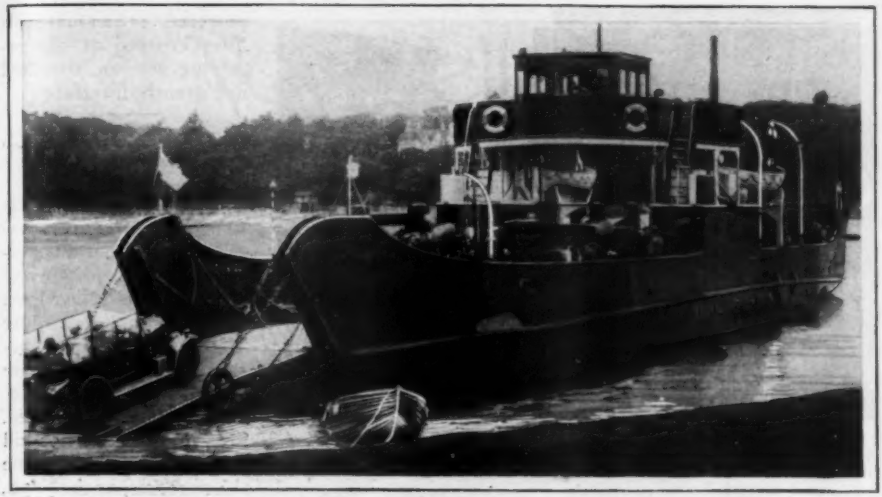
Radio communication with Mars is considered unlikely, in the opinion of E. O. Hulburt, of the naval research laboratory, because of atmospheric conditions on the planet and because of certain limitations there. The gist of the situation, as he sees it, is that the short waves which we might transmit to penetrate our atmosphere, if they did reach Mars, would probably find no receiver for them, since the Martians, if they have radio sets, very likely have gone in for those using long waves. The reason for this, Mr. Hulburt explained, is that short-wave broadcasting or receiving on Mars would be greatly hampered by what is known as the "skip distance" effect, a phenomenon experienced here. A short-wave transmitter might be operated in New York city, for instance, and received with great volume and clarity in Australia, but might be unheard 500 miles from New York. Instances similar to this have been noted during communications with the Byrd expedition in the Antarctic. Short-wave messages have been received clearly there from New York, but were inaudible on sets close to the transmitter. On Mars, Mr. Hulburt believes, the skip-distance effects are such that short-wave sets very likely are not used. Conditions here are such that waves longer than about 100 meters will not penetrate the earth's atmosphere, hence a short wavelength would have to be used in talking to Mars, but the probability is against its registering there because no set would be able to receive it.

AUTOS TESTED IN WIND TUNNEL TO IMPROVE DESIGN

How automobiles may be designed to decrease the wind resistance, and thus effect a saving in fuel with the possibility of greater speed, is shown in the wind tunnel at the bureau of standards. Model planes have been tested here for some time, to discover how the real ships will behave in the air, but recently similar experiments with small antomobiles have been made, the increased importance of speed tending to place greater emphasis on design. Wind velocities as high as 130

Model Automobile Ready for Test in Wind Tunnel, to Demonstrate Effectiveness of Streamline Design

miles an hour are created in the tunnel, and the resistance of the tiny models is quickly determined with the aid of exact instruments.



Auto Being Driven upon the Special Ferry That Carries Several Cars at One Time, and Saves the Drivers Time and Worry with Its Wide Entrance and Exit Ways

SPECIAL FERRY FOR MOTOR CARS CARRIES HUNDREDS DAILY

Automobiles are transported from Fishborne to Portsmouth, Eng., in a special ferry which has a large capacity and has been built to simplify the task of loading and unloading the cars. There is ample parking space on the deck, and wide driveways from the dock aid the drivers. Hundreds of cars are ferried in this craft daily.

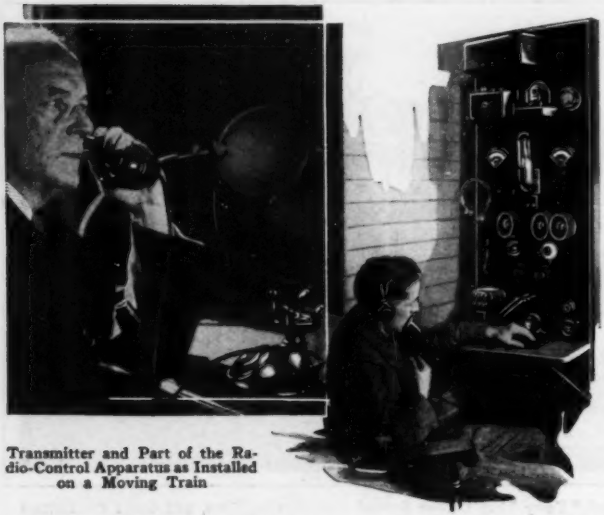
SLOT MACHINE THAT SPEAKS RESISTS BAD COINS

"Please use good coins only." These words, spoken distinctly by a hidden voice, admonish anyone dropping wooden nickels, slugs or other spurious coins in a slot machine recently introduced. The secret is an electrical arrangement by which the slug is ejected and at the same time a record is automatically switched on to reprimand the offender in a loud voice that can be heard a considerable distance. According to the inventor, the device is adaptable to almost any slot machine. He contemplated having the "robot" say "Stop, Thief," or "Arrest That Man," but decided that this would be unjust to persons who innocently deposited bad coins.

FOOTBALL MEN BUCK SPRINGS FOR LINE PRACTICE

Linesmen on the University of Nebraska football team practice against dummy opponents in the form of padded wooden frames and springs, to develop skill at plunging and other maneuvers. Coach B. F. Oakes calls the apparatus, which he invented, the "Biff'em machine," and declares that it gives candidates a thorough workout and conserves human material.

Padded Springs and Scrap Iron Take the Place of Human Players in Furnishing Opponents for Line Candidates on Football Team



Transmitter and Part of the Radio-Control Apparatus as Installed on a Moving Train

RADIOPHONE SERVICE ON TRAIN LATEST TRAVEL LUXURY

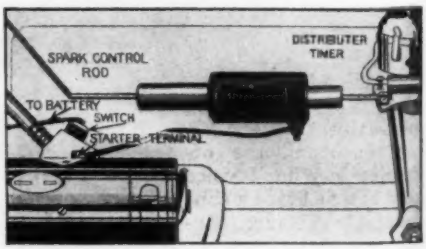
Two-way conversation by radio telephone from a moving train to a distant city, was successfully accomplished recently on the Canadian national railways, marking a distinct improvement over the one-way apparatus that has been used for some time in Germany. If the equipment proves practical for general adoption, travelers on railway trains anywhere will be able to talk to their friends from the cars and listen to the replies, as easily as telephone conversation is conducted between stationary points. Talking between moving trains is the next step in the development of this interesting improvement, engineers declare. As practiced in the Canadian test, the voice from the telephone instrument on the moving train passed from an antenna on the roof of the car, "jumped" across to the telephone and telegraph wires beside the track and, on these, was led into a receiving station where direct connection was established by telephone wire to the instrument of the called person in his office. The fact that the wires along the track were carrying telegraph messages at the same time, did not impair their efficiency in the telephone work, and the telegraph signals were not interrupted. Another interesting feature was the fact that, although three high-powered transmission lines crossed at the receiving station, they did not greatly interfere.

CEDAR WON'T KILL BIG MOTHS

Clothes chests constructed entirely of properly dried three-quarter-inch red-cedar heartwood will protect clothing from moths, only if the older worms are removed before the garments are stored, the bureau of entomology has determined. Such chests will not kill the adult moths, the older worms, or the pupæ, nor will they prevent eggs from hatching, but the young larvæ are killed if the grown moths have been removed by brushing, sunning, fumigation or dry cleaning. The mere odor of cedar, it was decided, will not kill the larvæ.

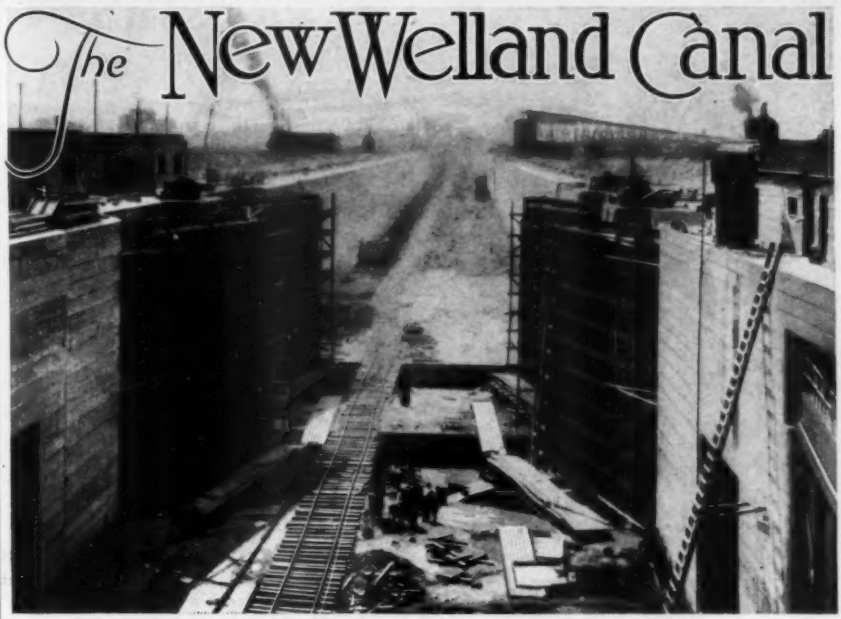
SPARK CONTROL IS AUTOMATIC TO STOP AUTO BACK FIRE

Back-firing is said to be effectively eliminated in the auto by use of an automatic spark controller which retards the spark before the starting equipment actually gets into action. It keeps the spark retarded until the motor starts, and then causes it to be advanced to its proper position for the greatest efficiency. The device is easily installed between the timer rod and the starter terminal simply by removing a few inches of the timer rod and making the proper connections.



Drawing of the Automatic Spark-Controlling Unit, Which Prevents Motor from Back-Firing

The New Welland Canal



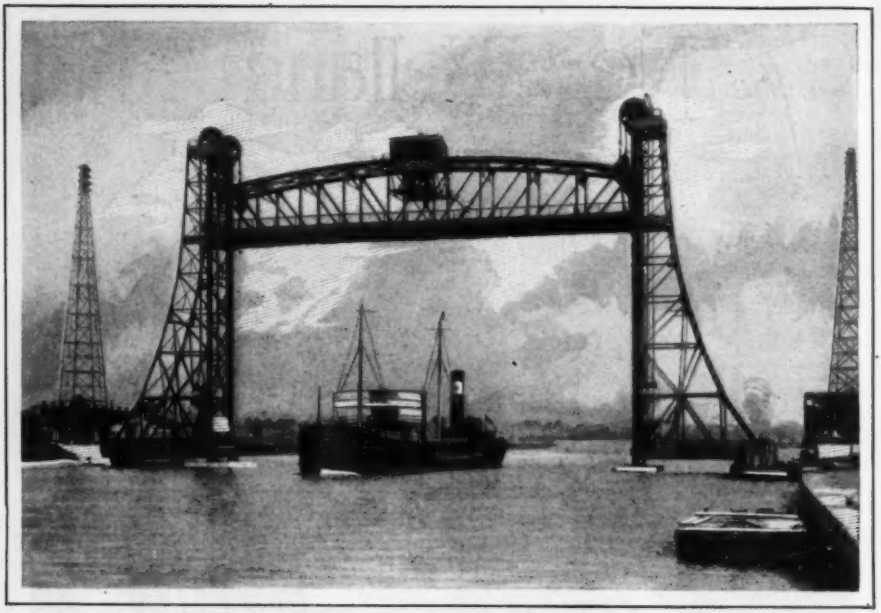
Looking Down What Is Claimed to Be the World's Longest Canal Lock, 1,380 Feet in Length and Eighty Feet Wide; It Is One Unit in the 325-Foot Lift of the Welland Canal

By EARLE W. GAGE

LONG before the dawn of the cement era, bold voyageurs, seeking a short route to China, visualized the inland seas of America linked with the Atlantic, as one continuous waterway route. These men of the sixteenth and seventeenth centuries, unheralded by radio, unwelcomed save by the few wandering savages, found their crude birch-bark canoes stopped in their progress by the projecting Niagara peninsula.

Today the genius of the builder, who has shaped and fashioned time-defying cement into a ship canal, thus creating one of the masterpieces of modern engineering, has at last brought to life the dream of the adventurers. For the new Welland ship canal, cutting a twenty-five-mile slice straight across Niagara peninsula, in Ontario, is nothing short of a monument to which future generations will point with pride. Projected by the Canadian government, at a cost of $120,000,000, this ship canal is an achievement which compares with any, and surpasses many world-famous canals. With its opening, the longest, deepest-draft "lakers," giant 600-foot grain ships, may steam from the head of the Great Lakes to the St. Lawrence. The canal has seven giant locks, each of which has a depth of forty-six and one-half feet, thus offsetting the 325½-foot difference in level between Lake Erie and Lake Ontario. It is 200 feet wide at the bottom, and vessels of thirty-foot draft may pass through it; by simply dredging out the bed, this depth may be increased at any time to meet future demands.

The canal has been divided into eight sections, the first beginning at the Port Weller terminal, on Lake Ontario. At this point, an artificial harbor was constructed, with two embankments extending out into the lake for a distance of one and a half miles. A concrete superstructure protects the entrance, which is 400 feet wide and broadens to a bottom width of 800 feet, providing 150 acres of water.



One of the Lift Bridges Spanning the Canal, As It Appears When Raised to Permit a Lake Freighter to Pass Beneath; in the Background Are the Towers of an Electric Power Line

At Port Colborne, Lake Erie entrance to the canal, a breakwater to protect the entrance was constructed by sinking giant reinforced concrete cribs on a prepared bottom and covering them with a heavy concrete superstructure. This is further protected by a heavy rock embankment. The reinforced-concrete cribs are 100 feet long by thirty feet wide and vary in height from eighteen to thirty-one feet. They were constructed at Port Maitland, some twenty miles west of the canal, towed to location and sunk by opening valves in the bottom. To insure safe entrance to the protected area, ships have the way lighted by a reinforced-concrete lighthouse, which stands at the south end of the breakwater.

The lock structures, in which a fabrication of steel and concrete forms the walls, insuring durability and permanence, are really engineering achievements. The single locks have a length between gate pintles of 859 feet, giving a usable length of 800 feet. The side walls consist of concrete monoliths, the greatest thickness of which is forty-six feet at the base, stepped in toward the top to a width of sixteen feet. These walls contain various tunnels and passages near the top, and the main longitudinal culverts near the base.

The twin locks are similar to those in use at the Panama canal. The Gatun locks have an eighty-five-foot lift, while those on the Welland canal have a lift of 139½ feet. These locks are 820 feet long and eighty feet wide. At the highest point in the lock walls, the huge structure towers more than 130 feet in the air. The giant gates, which control the flow of water and thus lift or lower the large ships, are among the largest in use.

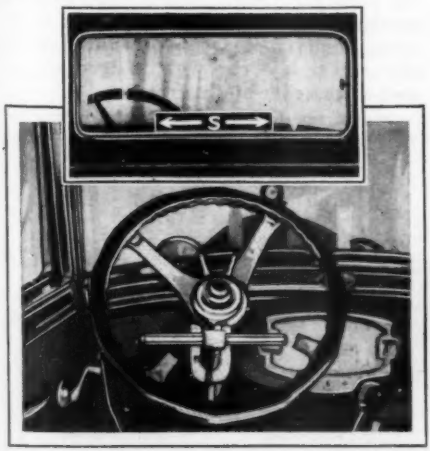
The projection of the canal called for rare engineering skill. The greater part of the lift over the Niagara escarpment occurred within a comparatively short distance. This necessitated excavating down to eighty feet, to bury the bottom of the locks in the rock. The excavation was done in the dry, and protection to the bank was placed before the earth bank was cut and dredged away. The prism section of the canal allows for a bottom width of 200 feet, with suitable slopes protected by concrete work, and a waterline width of 310 feet.

LATEST FLIGHT TOWARD SUN SETS NEW MARK

Official announcement was made recently that Lieut. Apollo Soucek, of the navy, flew nearer the sun than any man on record when he worked his little plane skyward over the naval air station last May. The bureau of standards, after calibrating the barograph Lieutenant Soucek carried, announced that the official altitude reached was 39,140 feet. This exceeds the previous mark made by Lieut. C. C. Champion, who flew the same plane to a height of 38,418 feet in the summer of 1927. An Italian flyer bettered Lieutenant Champion's mark, but his feat was not recognized officially, for it did not exceed the previous altitude by 100 meters.

DAY-AND-NIGHT AUTO SIGNAL PROMOTES DRIVING SAFETY

Installed in the lower part of the rear window of the automobile, a direction signal, operated by buttons on the steering wheel, plainly indicates to drivers behind, by day and by night, whether a right or left turn or a stop is to be made. A green-arrow signal flashes for a right turn, a red for a left and a stop is designated by an amber-colored "S," which is lighted with the action of the brake pedal. The lenses show no color except when the signals are flashed.



Signal as It Appears in the Rear Auto Window, and the Control Buttons on the Steering Wheel

Honoring Columbus at the Place of His Sailing; the Huge Statue Executed by Mrs. Harry Payne Whitney

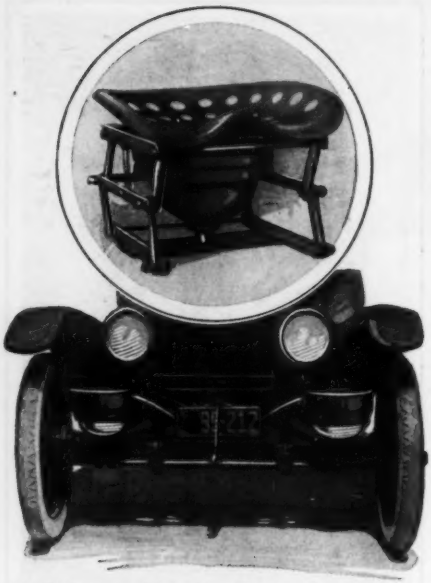
STATUE OF COLUMBUS MARKS SPOT OF HIS SAILING

Palos, Spain, is now marked with a seventy-foot statue of Columbus to indicate the spot from which the discoverer sailed to find the "new world." The figure stands on a base forty-four feet high and was executed by Mrs. Harry Payne Whitney.

SHRIMP OFF ALASKAN COAST ENTER AMERICAN MARKET

Alaska has entered into active competition for the American market for shrimp, although clinging to catching appliances that are considered antiquated elsewhere. The catch at present amounts to about 500,000 pounds of meat, valued at $200,000, and most of the shellfish are taken with the old trawling devices, because the great depth from which most of the catch is obtained makes impracticable the Chinese bag nets and traps, and the cast nets and seines used in San Francisco bay.

¶Ink made from straw was used recently in printing a newspaper.



Air Springs as Adapted to Tractor Seat and Auto Chassis; the Flexible Casing Contains an Inner Tube

AIR SPRINGS ON RIDING SEAT HELP PROMOTE COMFORT

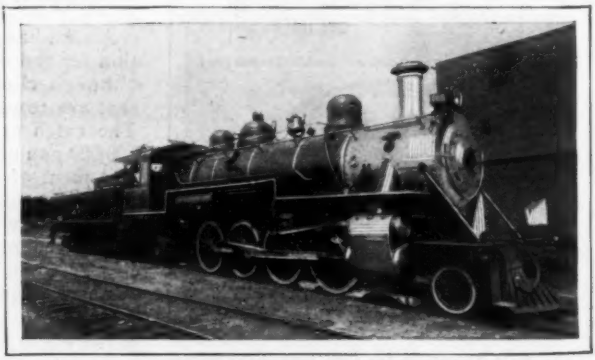
Air springs, intended to take the place of steel ones on any riding device, have been devised by a western company. The spring consists of an inner tube and an outer flexible casing, built like a pneumatic tire, the action being improved by the use of a deformer. According to the manufacturers, the springs can easily be adapted to the weight of the load carried, whether it be an infant in a carriage or a load of passengers in a Pullman car. Twelve of these springs would be sufficient to support a railroad car, it is said. According to reports, the units are especially suitable for farm tractors and other vehicles where fatigue is often induced by the uncomfortable seats usually provided. Fastenings are provided so that a seat attached to the pneumatic spring always moves vertically without side motion.

DE-LUXE TRAIN IN AFRICA HAS FLEXIBLE CARS

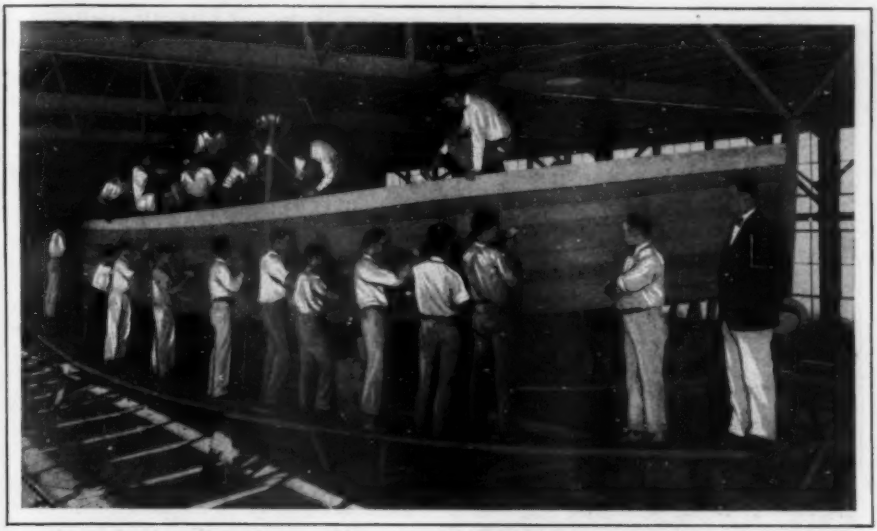
Travelers in the Union of South Africa may now enjoy luxurious railroad accommodations on a de-luxe train recently placed into service. One of the most conspicuous features is that the coaches are flexible, that is, they have a joint in the body work over the center set of wheels. Frameless windows that slide in felt-lined grooves and cannot rattle, telephones between the cars on the train, shower baths and other comforts provided on the best trains of the world are included in the equipment.

AUTO FINISH ON LOCOMOTIVE TO AID IN CLEANING

Gleaming in a coat of dark-blue auto finish and striped with aluminum paint, a locomotive, recently purchased by the Georgia Northern railway, has several interesting departures from the usual engine. The front number plate and the letters and other numbers are chromium-plated, while the machinery parts and cylinder-head covers are of polished steel. Bands of monel metal surround the boiler jacket, sand boxes and the steam dome. Welding replaces riveting on several of the parts, to simplify repairs and to give increased strength. The locomotive is to be used for freight duty and, with its tender, weighs 165 tons. Another interesting unit employed by this railroad is the automobile car with flanged wheels and cowcatcher at the front.



Chromium Plate, Auto Finish and Aluminum Striping Add to the Handsome Appearance of This Georgia Northern Locomotive



Students in Miami High School Building Boat under Direction of Master Craftsman; Classes in This School Constructed Three Yachts during the Recent Year

SCHOOL TEACHES BOATBUILDING TO BOY CRAFTSMEN

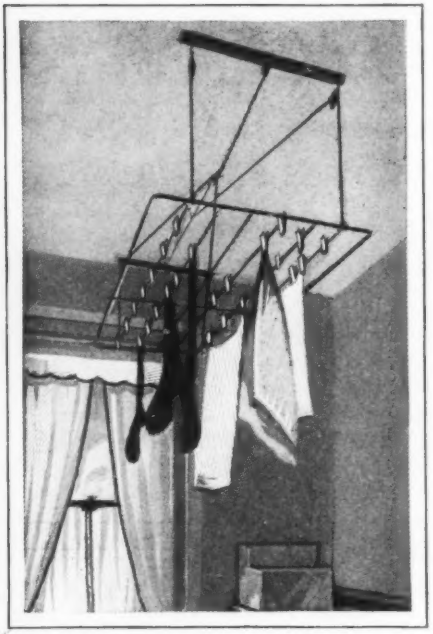
Under the direction of a master boatbuilder, boys in the manual-training department of a Miami high school are taught how to construct seagoing yachts and other craft. During the recent school year, three boats, valued at $48,000, were built by the young shipwrights from materials furnished by the owners. The course in boatbuilding is part of the school's curriculum, and the cost is partly defrayed by the money derived from the customers. A fifty-foot cabin cruiser, powered with a 225-horsepower motor; a fifty-four-foot raised-deck cabin cruiser for ocean trips, and one smaller boat were built during the past year. The boys are taught every step of the process, and many prefer to spend overtime in the school shops rather than engage in sports.

RECOVER OIL-WELL DRILL BITS WITHOUT "FISHING"

To eliminate the costly process of "fishing" for broken oil-drill bits and pipe when breakages occur in sinking wells, a California inventor has devised a special socket and cable attachment. It is fixed to the drill bit in such a way that, should the bit break, it could be pulled up with the pipe and not fall into the hole. Operators sometimes spend $1,000 or more in "fishing" for broken bits, and occasionally, when the part cannot be found, another hole has to be started.

RUBBER CAPS FOR BOTTLES USED REPEATEDLY

Made of a durable rubber compound, bottle caps now on the market are easily put on or removed and may be employed repeatedly. To put them on, the rubber is moistened and the cap fitted over the top of the bottle on one side. By pressing down with the thumb, the cap is forced into place and becomes fastened with a clicking sound that tells it is tight. To remove the cap, simply press upward with both thumbs. This forces the rubber away from the glass.



Clothes-Drying Rack Attached to Ceiling of Kitchen Where It Is Out of the Way

CLOTHES DRIER ON CEILING SAVES ROOM SPACE

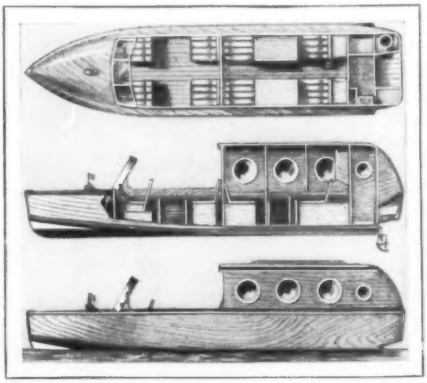
For drying clothes, a lightweight frame, that may be lowered for hanging the garments and then raised out of the way, is suspended from the ceiling to save space. It rests where the greatest benefit is obtained from the warm air.

CHANGING LIGHTS TURN TOWER INTO FOUNTAIN OF COLOR

Constantly changing floodlights along with tube lights and aerial beacons transform the twenty-eight-story Rand building in Buffalo into a fountain of color by night. The symphony in lighting begins at the eighteenth floor with floodlights, running the gamut from blue to ivory and back every four minutes. At the twenty-third floor, where a second terrace begins, floodlights changing from red to white every two minutes illuminate the building to the roof. A forty-foot steel tower surmounting the second terrace is ablaze with tubes of fiery red light, and atop the tower, 425 feet above the street, a fixed white shaft of 4,000,000 candlepower points the way to the Buffalo airport. Surmounting the ensemble of light is a 10,000,000 candlepower aerial beacon tracing a red halo through the night skies every thirty seconds. The engineers obtained the effects by employing simultaneously three methods of exterior illumination, using floodlights for the terraces, tube lights for the tower and fixed and rotating aerial beacons at the top. The red and blue floodlights are not dimmed, thus allowing various combinations of color as the white lights blaze forth. If one lamp fails, another is switched into operation.

OUTBOARD MOTORBOAT CRUISER HAS MANY LUXURIES

Conveniences of larger and more elaborate craft are afforded in a twenty-one-foot cruiser, powered by an outboard motor and with a draft of less than six inches, so that it can be operated in shallow water. There are sleeping accommodations for four persons, comfortable seats and tables, a cooking galley, lavatory and other features generally associated with much larger craft. The boat develops a speed of twenty miles an hour and will run twelve miles on a gallon of gasoline. There is storage space for extra supplies of fuel. A special feature of the boat is the composition rubber material on the bottom. According to reports, tests have shown that, although the hull may be stove in, the rubber material remains unbroken and water-tight.



Drawings of the Outboard Motor Cruiser to Show Its Roomy Accommodations and Conveniences

DETECTIVES' TOOL KIT TO HELP TRAP CRIMINALS

Detectives' Implements Unpacked and the Kit as Carried to the Scene of a Crime

Members of the homicide squads of New York's police department have been equipped with kits of special tools to aid them in trapping criminals and solving crimes. The outfit includes a magnifying glass, a flashlight that can be operated continuously for seven hours without renewing the batteries, a tape measure, calipers and a set of test tubes for preserving samples of hair, etc. The kit also holds a fingerprinting set with a blowgun for applying powder, rubber gloves, a saw, tweezers, hammer and chisels, a special "trouble-finding" flashlight on a lanyard, paper, twine, colored crayons and a stenographers' notebook. All these implements are fitted in a case which the detectives carry with them when sent to the scene of a serious crime.

Every criminal investigation presents different problems and there is no foretelling when use will have to be made of the special tools. For instance, if bullets have to be dislodged from a wall, the hammer and chisel are put into service. Rubber gloves are needed in handling electric wires, and the mirror has many uses.

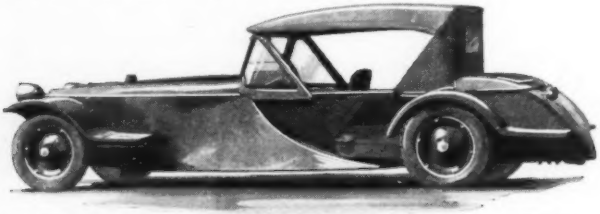
Working on Airplane That Is to Be Propelled by Rockets, a System Developed by Fritz Von Opel

ROCKETS AS MOTOR SUBSTITUTE TO PROPEL AIRPLANE

Having demonstrated that rockets will run automobiles and motorcycles, Fritz Von Opel, German sportsman, is planning to apply the principle to operating an airplane. A special ship has been constructed for the tests, at Griesheim, Germany. Greater speed than is possible with ordinary motors is anticipated from this new development.

COMBINATION AUTO AND BOAT DEVELOPS HIGH SPEED

Adapted to travel on land or water with scarcely any alterations, a combination automobile and boat developed by an Iowa inventor has attracted wide attention. It is built of rust-resisting steel, weighs but 3,200 pounds fully equipped, and is said to develop a speed of seventy-five miles an hour on land and twenty-five in the water. Air tanks in the front and on the sides, keep the car from sinking when it is used as a boat, and the propeller is attached at the rear, where it does not interfere with the operation of the machine as an automobile. Seven persons can be accommodated in the roomy body.

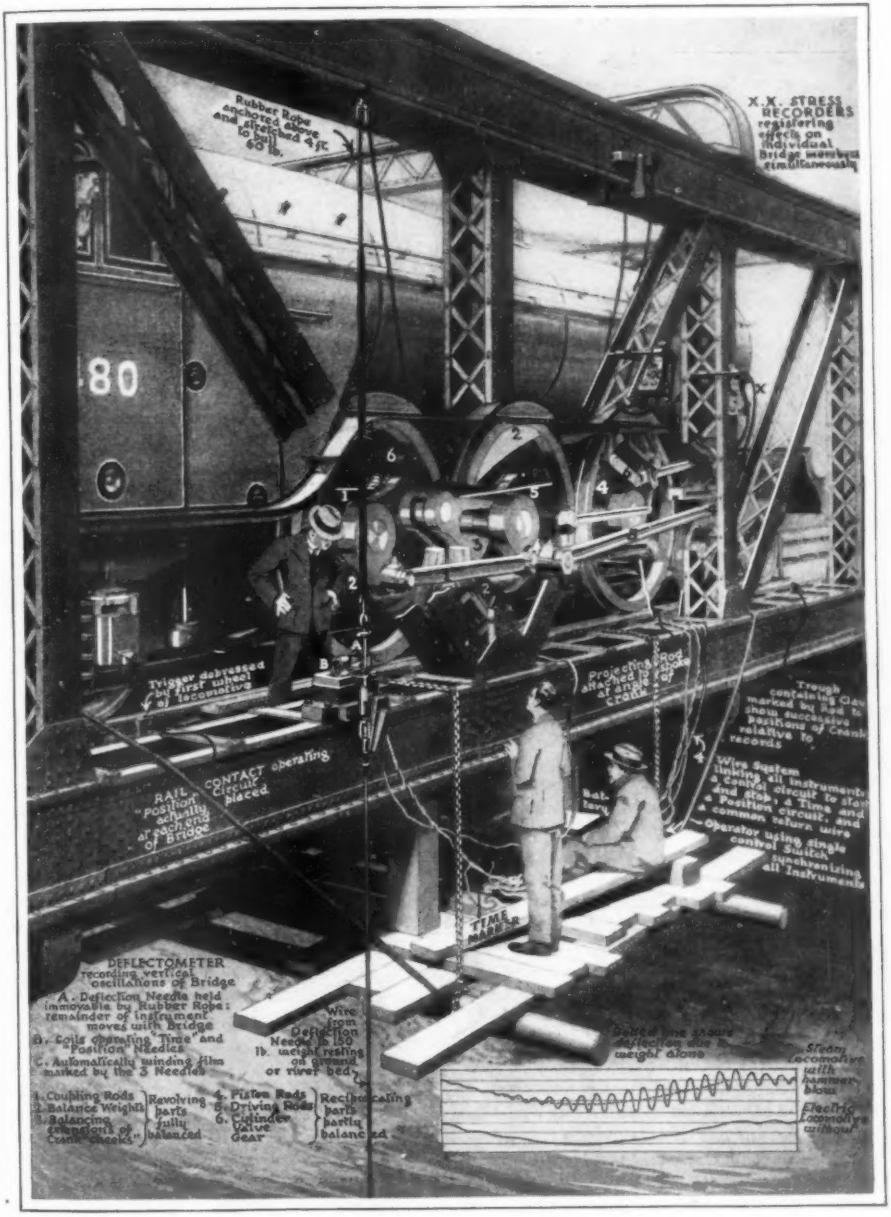


Steel-Body Auto That Also Operates as a Boat; the Propeller Is Visible to the Right of the Rear Wheel

HAMMER BLOWS THAT MENACE BRIDGES ARE MEASURED

Measuring the hammer blows inflicted on railroad bridges by the wheels in each revolution, discloses, according to a bridge-stress committee appointed by the British government, that the impact force may be as much as twice the normal weight of the engine on each axle. The blow, which comes with each full turn of the revolving and reciprocating connections to the driving wheels, is not felt by the engine, because the counterbalances of the connecting rods eliminate it, so that the locomotive rolls smoothly forward, but the balancing fails to protect the track. The committee set up electrical recording instruments on fifty-two English bridges, with spans ranging from sixteen to 345 feet, and sent thirty-nine different types of locomotives across them at speeds ranging up to seventy miles an hour. The "deflectograph" records showed the difference between steam locomotives, with their reciprocating parts, and electric locomotives, which have none. In each case, a curved line indicated the deflection of the bridge under the weight, but, with the steam locomotive, a second pen showed a series of waves, due to the momentary change in pressure of the wheels in each revolution. A rod attached to the wheels scraped a trough of clay at each revolution, and furnished a check on the pen record, to show that the waves corresponded to the pounding of the descending rods. The records of a steam and an electric locomotive are shown in the insert at the bottom of the artist's drawing on the opposite page. The swaying of locomotives, produced when the counterweights are not in the same plane as the connections they balance, was also studied.

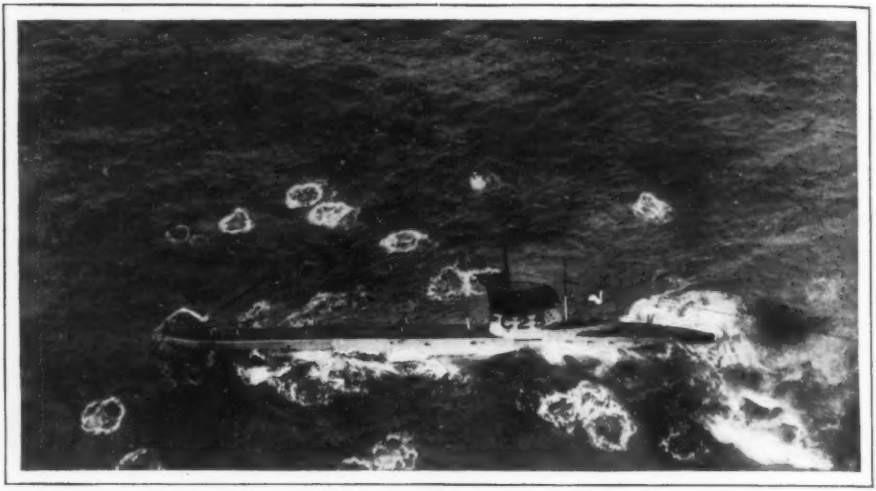
HOW MUCH DOES A STEEL RAILROAD BRIDGE BEND?


Rubber Rope anchored above and stretched 4 ft. to pull of 60 lb.
X.X. STRESS RECORDERS registering effects on individual Bridge members simultaneously
Trigger depressed by first wheel of locomotive
Projecting Rod attached to cross head of engine
Trough containing Clay marked by Rod to show successive positions of Crank relative to records
RAIL "POSITION" actuating switching of Bridge
CONTACT operating circuit placed
Wire System linking all instruments to a Central circuit to start and Stop, 4 Times and a Position circuit, and a common return wire
Operator using single control Switch synchronizing all Instruments
TIME MARKER
DEFLECTOMETER recording vertical oscillations of Bridge
A. Deflection Needle held immovable by Rubber Rope: remainder of instrument moves with Bridge
B. Coils operating "Time" and "Position" Needles
C. Automatically winding film marked by the 3 Needles
Wire from Deflection Needle to 150 lb. weight resting on ground or river bed
1. Coupling Rods
2. Balance Weights
3. Balancing (sometimes on Crank Pinnacles)
Revolving parts fully balanced
4. Piston Rods
5. Driving Rods
6. Cylinder Valve Gear
Reciprocating parts partly balanced
Dotted line shows deflection due to weight alone
Steam Locomotive with hammer blow
Electric Locomotive without

Copyright, S. W. Clatworthy

Engineers with Apparatus Used for Measuring the Stresses on a Bridge Span as a Locomotive Thunders across It at Nearly Seventy Miles an Hour; Every Strain Is Recorded by Electrical Instruments

WAR SECRET IS REVEALED AFTER ELEVEN YEARS



Courtesy Imperial War Museum

Under Bombardment from German Planes, the British Submarine "C-25" Limps Slowly Along; Striking Photograph of a Thrilling War Incident Just Revealed

A striking photograph, recently released from the secret archives of the German government, tells the thrilling story of a war-time encounter between two British submarines at sea and a flotilla of enemy seaplanes off Harwich, on the North sea, England. For over eleven years the secret has been kept from the knowledge of British and German people. One morning in July, 1918, the British submarine "C-25" began a patrol of the Flanders coast, occupied by the enemy. Coming to the surface, her commander, Lieutenant Bell, hastily called up his second in command to have a look at five enemy seaplanes.

Cobb, the second in command, sprang up the ladder to the hatch and was about to step out on the deck when he heard his chief shout an order to dive. All main ballasts were flooded and full speed ahead telegraphed to the engine room. But before the orders could be carried out, there was a tearing crash and dense fumes arose from the deck. Two bombs had hit the casing. An inrush of water into the pressure hull forced the commander to countermand the order to dive. Then the enemy seaplanes swept down again.

Lieutenant Cobb went to the conning tower and found his chief and four others dead on the bridge. Followed a succession of tearing and rending crashes, as the seaplanes, circling overhead, rained down a hail of bombs and explosive bullets. The projectiles hit the water all round the helpless submarine. Her rudder was smashed, compasses wrecked, and her bridge was seething in a dense cloud of steam hissing from a holed exhaust while she was trying to forge ahead on the gas engines. The crew plugged up the holes with their clothing and began desperate efforts to pump the bilges in order to remain afloat. The bombardment from above lasted for an hour, till, at 11 o'clock, a lull set in, and the British submarine opened her lower hatch. The action was spotted by an observer on a seaplane above, and at once two seaplanes rushed to the attack. Quickly the hatch was shut, and another lull occurred, until about noon, another British submarine, "E-51," was sighted. The disabled sub sent up Verey lights, and the "E-51" went to her aid. A line was put out, and the crippled submarine was about to be towed in the direction of her base at Harwich, when once more the roar of wings was heard, and the enemy squadron of seaplanes were seen approaching to renew the battle. The

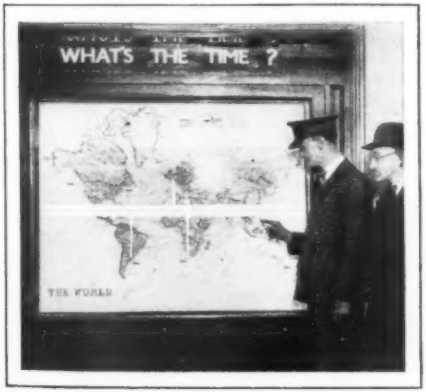
towline was at once cast off and "E-51" dived for the bottom. Thirty minutes later she rose to the surface to find the attackers mere specks in the sky. Away on the horizon there was the smoke of a destroyer, wirelessed for aid, and rushing to the scene. In an hour, the British destroyer "Lurcher" came up, took off all survivors and towed the crippled "C-25" back to harbor.

WASHES FOR CITRUS FRUITS REDUCE DECAY LOSSES

Various disinfectant washes have been tested by the bureau of plant industry with a view to developing practicable methods for eliminating an estimated loss of $100,000, or more, annually in the decay of citrus fruits while being shipped from California. The substances tried include borax, sodium bicarbonate and some of the strong alkalies. Treatment with sodium bicarbonate is reported to have produced excellent results.

BIG MAP SERVES AS CLOCK TO TELL WORLD TIME

Time for all parts of the world is quickly told by means of a map which has been placed near a subway station at Piccadilly, London. On the chart is a ruled band or gauge which is moved opposite the location of the spot for which the correct time is sought and also gives the comparative hours for different cities of the world.



Map with Sliding Indicator, by Which Time Can Be Told for Any Part of the World

Demonstrating Electric Guard That Lights Lamps and Rings Signal to Prevent Railroad Collisions

ELECTRIC GUARD STOPS TRAINS TO PREVENT COLLISIONS

To eliminate collisions, a Berlin railway has been testing an Italian's invention in the form of an electric watchman that helps halt the train before an accident. The device is installed on the front of the locomotive and consists of a gong and a special light. Should the train approach within 1,300 feet of another, also equipped with the warning device, an electric circuit would be closed, ringing the gong and causing the lights to flash as warning to the engineer to stop his train. In the tests, a wire was used to operate the alarm. It was stretched down the middle of the track, but the wire is to be eliminated in favor of the rails which will be charged to carry the current operating the signal.

¶Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and will be furnished free upon application to our Bureau of Information.

Easier Ways

High Chair, Rocker and Bed, All in One Easily Adjusted Unit, Save Space in the Nursery; the Idea Is the Creation of a German Inventor

Tomatoes Are Easily Sliced in Uniform Thicknesses by Using This Holder, Which Also Protects the Fingers

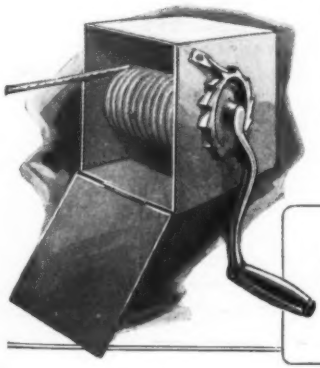
Folding Kitchen Table, Illustrated at Right and Above, Is of Metal; the Top Is Enameled and the Iron Braces Prevent Wobbling; the Table Fits into a Space Three Inches Deep, and Is Also Adapted for Motor Trips, as It Occupies But Little Room in a Car

# of Doing It

It Takes the Heart Out of Grapefruit; This Rotary Cutter of Stainless Steel Also Squeezes the Core Dry, to Help Save Juice

The Chief Feature of This Flower Holder Is That It Has a Lead Base, to Keep It from Slipping or Tipping Over; It Is Adapted Especially for Shallow Bowls and Low Centerpieces

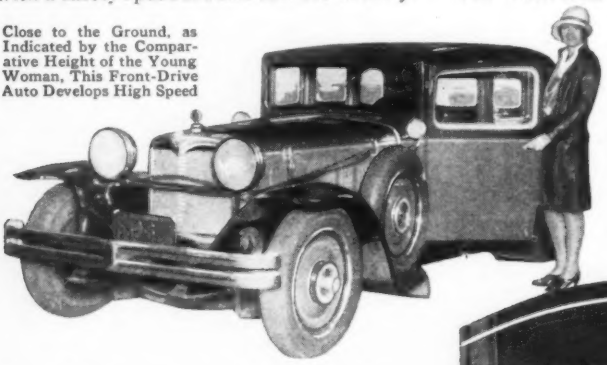
Emergency Washings Are Simplified with Metal Plunger Young Woman Holds in Her Right Hand; at Its Top, Is a Compression Air Valve, and as It Is Operated Up and Down, Air Bubbles Are Forced through Fabric, While Rings at Bottom of Bell Keep the Bubbles Moving Back and Forth



Metal Clothesline Holder Keeps the Rope Dry and Clean When Reeled In, Is Easily Attached and Allows Quick Tightening of the Line

FRONT-DRIVE AUTO DEVELOPS MORE SPEED AND POWER

Speed of eighty to 100 miles an hour with a safety speed around corners of forty-five miles an hour is claimed for a front-drive automobile recently introduced. Its eight-cylinder motor is reversed on the chassis and power is applied directly to the front wheels by a short driveshaft using four universal joints. The car weighs 2,500 pounds, its highest point is but five feet above ground and it has a wheelbase of 130 inches. All the mechanism, except the rear wheels, is in front of the driver.



Close to the Ground, as Indicated by the Comparative Height of the Young Woman, This Front-Drive Auto Develops High Speed

PENNIES LOST IN SINGLE YEAR TOTAL SMALL FORTUNE

It is estimated that from 5,000,000 to 10,000,000 one-cent pieces disappear annually. The penny is the favorite coin of many business enterprises and to supply the demand, the government mints three and three-quarter billions of them every year. Because of their slight value, they are not counterfeited. Possession of even one of the silver dollars of 1804 would net the owner a neat sum. The government coined 80,000 of these dollars, sent them to the paymaster of the United States fleet off Tripoli, where trouble was brewing with the Barbary states, and few of the coins ever returned to this country. Most of them were traded by the sailors to the Bedouins for supplies. Some time ago, a bank in Boston paid $2,000 for one of the 1804 dollars. One of the rarest of the United States coins is the half eagle of 1798, made at the first mint in Philadelphia. Some authorities assert that there are but three of these coins in existence, and that one of them is now in the possession of the government. The bank of New York is in possession of two interesting coins, respectively called the "sundial" or "Mind Your Business" cent and the "Ring" cent. Both were coined in the city of New York in 1787, and their appearance was heralded with joy by the papers of the time as a means of "freedom from the impositions of the light-weight British halfpence."

SAFETY IN FLYING IS SHOWN IN INSURANCE POLICIES

That there is much less risk in aviation than in the early days of flying is shown by the deletion of anti-air-travel clauses from many insurance policies. Out of fifty leading insurance companies, forty-two no longer include the clause or have modified it in such a way that payments are authorized even in the case of an air accident or fatality. At the same time, there has been a marked reduction in the rates charged for special aviation policies.

¶ California and Florida are the only states in this country where nutmeg trees grow.

WIND BLOWS TONS OF DUST TWO THOUSAND MILES

Several tons of dust from Australia, suspended in the air, were blown more than 2,000 miles and deposited in the South Island of New Zealand, not long ago. A great part of the journey was made over water. The phenomenon was not unusual in itself, as similar happenings have been recorded before, but the volume and the area covered were unusually large. The dust was brought down by rains which were so discolored by the material that the jerseys of two teams of football players, engaged in a match, could not be distinguished because their contrasting colors were deleted by the muddy downpour.

STEEL-RUNG SAFETY LADDER EASILY TAKEN APART

With steel rungs and an adjustable extension that can be operated with one hand, a patented safety ladder now on the market is said to offer several distinct advantages over the usual article. No screws or nails have been used, a locking device, operated by a spring, simplifies the adjustment of the extension, and the ladder can be taken apart in a few seconds. It is light in weight and built for long service.

Connecting the Steel-Rung Safety Ladder Is Easily Accomplished by Manipulating Two Finger Clasps

Electric Control Attached to the Motion-Picture Camera; the Arrangement Permits the Operator to Conceal Himself

REMOTE CONTROL FOR CAMERA AIDS "TRICK" PHOTOGRAPHER

Remote control for the motion-picture camera, to help in taking pictures of birds or animals or in "trick" photography, has been introduced in the form of an electrical attachment easily operated and connected. A telegraph key cuts current from a forty-five-volt radio battery to a magnet, releasing the button on the remote control for a single frame or for continual operation. Each tap of the key exposes one frame of the film.

JAIL SMUGGLING IS STOPPED BY CAGES OVER WINDOWS

Steel cages of projecting bars outside each cell window have put a stop to the smuggling of saws and other articles to prisoners in the Dallas county, Texas, jail. Rather than close the barred windows to prevent the prisoners from obtaining articles by making ropes of bed clothing and dangling them outside for confederates, the authorities spent $15,000 in erecting steel cages about each window, extending outward from the window about four feet, thus making such smuggling impossible.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

Part of the Scaffolding and Steps Erected at Side of Cliff Where Highway Tunnel Was Dug in Utah

TUNNEL DUG FROM SCAFFOLDS ON MOUNTAIN CLIFF

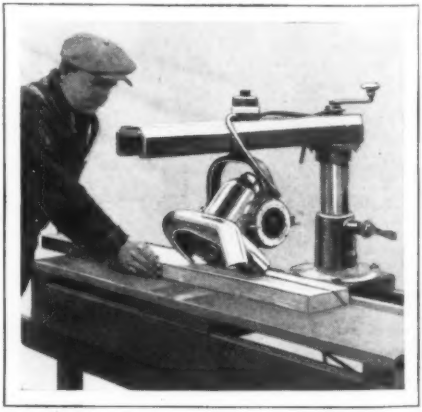
Steps and scaffolds were erected along the face of a steep cliff in Utah during the digging of a highway tunnel to shorten the distance between Zion National and other parks in the district. Instead of starting from either end, as is usually done, engineers began the bore from the sides of the mountain.

NEW METAL LIKE PLATINUM FOUND IN GRANITE

Resembling platinum in appearance, and having some of its qualities, columbium, a metallic element, was exhibited for the first time at a chemical meeting in New York. It is thought to exist in large quantities deep down in the earth and, at present, is found in certain granite veins in combination with another metal. Its cost is one-tenth of platinum, and experts are now studying its properties to determine what use can be made of it. Platinum has increased in value in the last few years, persons attending the exposition were shown. A Russian coin of the substance, minted in 1828, contains platinum worth twenty times the face value of the coin. Chemists were also interested in a rust-resisting alloy which has been developed at the Krupp factories in Germany.

MOTOR SAW DOES MANY JOBS

Twenty-nine distinct cutting operations are performed by a motor saw that is run from a lighting socket on alternating or direct current. Instant change from crosscutting to ripping is accomplished without stopping the motor, and on two-inch stock, the twelve-inch combination crosscut and ripsaw, rips at the rate of twenty lineal feet per minute. Dadoing, routing, mitering, shaping and grooving are among the jobs done by the outfit. It is mounted on a wooden table, weighs 235 pounds, and is easily carried from place to place by two men. The woodworker has a roller-bearing arm, for easier operation, and an adjustable guard.



Woodworking Outfit in Operation, Showing the Adjustable Arm and Flexibility of the Saw Head

OIL *from* FLORIDA TREES

One Hundred Pounds of Tung-Oil Nuts, Grown in Florida, Yield Four and a Half Gallons of Commercial Oil; the Tung Tree Was Imported from China, Where It Has Long Been Used

MECHANICAL giants which perform the work of thousands of Chinamen are now in use as the dependable aids of America's newest essential industry, the extraction of tung oil from the meats of nuts gathered from heavy-bearing Chinese trees raised successfully in the southern parts of the United States.

Science acclaims tung oil as the finest drying oil and base for paints and varnishes known to modern industry. It is a valuable material of a thousand new uses, as yet unrealized because China, which has previously controlled the world output, refused to standardize its production by the substitution of mechanical appliances for the unsatisfactory haphazard hand labor employed there.

Tung oil is necessary in the manufacture of waterproofing, quick-drying paints and varnishes. The electrical industry reports the oil essential in the manufacture of the insulating compound used in dynamos, cables and wire coatings. All the exterior varnished parts of naval and commercial ships are finished with tung oil. This oil is an important ingredient in automobile brake linings. The gaskets on steam pipes, pumps and engines are held together with tung oil. The undercoat finish of your new motor car relies on this material for its moisture resistance. Tung oil would also enter more extensively into the manufacture of all paints, linoleum, oilcloth, and other waterproof materials, if there was enough of it available in the United States for such purposes. Research specialists say these are but a few of the ever-increasing uses to which this drying oil could be put. More than 250,000 gallons a year are employed in enameling the tubes which are used as containers for cosmetics, shaving cream and other toilet preparations.

Some twenty years ago, the U. S. government, sensing the international importance of tung oil and the many drawbacks in oriental control of the market, secured experimental seed and started cultural experiments in several states. Eventually it was discovered that north central Florida, which lies in the same

A Three-Year-Old Tree in Bloom, and a Nut Cut in Half to Show the Five Kernels Containing the Oil

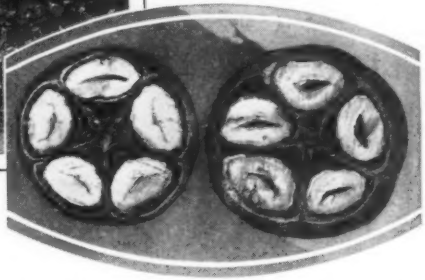
latitude as the leading Chinese tung-oil groves, was suited to these trees.

The federal department of agriculture and the Florida state station experimented for years, checked and rechecked results before they ultimately announced that the success of tung-oil-tree growing was assured. The American Paint and Varnish manufacturers' association co-operated in the experiments.

How compete with cheap oriental labor? was the critical question which arose after the investigators ascertained that "oil farming" was practical.

Mechanical ingenuity and inventive resourcefulness solved that riddle. One thousand Chinamen, who work for fifteen cents a day, cannot perform as much work as a small mechanized and electrified plant which research has perfected for the extraction of commercial oil from the nuts.

The Chinese practice crude primitive methods of oil extraction. They crack the nuts by hand and place them sacked in a large slot cut in a log which is three feet thick. The oil is then expressed by driving a number of wooden wedges into the slot. Only about two-thirds of the oil is recovered, the balance being wasted. The oil is then placed in containers and carried by human bearers and mules to the seacoast. There it is adulterated with soybean and peanut oil and finally is loaded in tank steamers for delivery to the United States. Even allowing for our expensive labor and high freight rates, transportation in the United States costs less than one-fifth as much as in China.



Experts of the bureau of standards assisted in the design and development of the special machines which have been invented for the cleaning, grinding and expressing of the American-grown tung-oil nuts. The nuts, which are from two and a half to three inches in diameter, are allowed to dry on the ground for several weeks after they fall from the trees. They are then picked up by hand and delivered in bags to the oil mill. Efficient machinery, operated by electricity, and power conveyors eliminate all human labor at the mill. The nuts are unloaded by electrical machines which deliver them to powerful decorticators that cut away

This Mill, Handling the Nuts from 6,000 Acres, Does the Work of 1,000 Chinese Laborers; at Right, the Waste Hulls Are Delivered Direct to Motor Trucks

the hulls and transfer the nuts to an electrified fanning mill which shakes them at high speed and eradicates all foreign material. A special suction blower, motor-driven, conveys the hulls and other wastes to the exterior of the plant where they are delivered into trucks and wagons or dumped on a refuse heap.

Electrical conveyors carry the cleaned, hulled nuts in a steady stream to cracking machinery which hammers them just hard enough to break the shells and prepares the meats for oil extraction. The cracked nuts are thence conveyed to the mighty maws of the electrical grinders and finally are delivered to the powerful presses which squeeze out and collect all the oil that can be expressed.

Each expeller can extract sixty gallons of oil an hour, while one decorticator is geared to hull and clean enough nuts to keep two expellers busy at top speed. Each cracking and grinding machine is also qualified to handle enough nuts to produce 120 gallons of oil an hour. The specialized machinery devised for tung-oil manufacture is also adapted for both corn-oil and cottonseed-oil expression.

The ground meats of the tung-oil nuts are kept in constant agitation by rapidly turning paddles which deliver them to the press in the accurate quantity for maximum oil recovery. The material is exposed to a pressure of 5,000 pounds per square inch, the by-product cake, which has a fertilizer value of $40 a ton, being as dry as sun-warmed beach sand after the oil-extraction process. The hulls are also ground and used as fertilizer. These by-products

replace costly commercial products in the growth and development of the Florida tung-oil groves.

Thus far, tung-oil production in this country has been conducted purely along experimental lines, although more than 500,000 trees now have been set out and one large paint company has established an 1,800-acre plantation near Gainesville. Altogether, approximately 500 farmers have developed experimental Florida plantings with the purpose of growing up with the business and enlarging their groves as they master all the problems of tung-oil production. The 200-acre experimental plantation of the American Paint and Varnish manufacturers' association, as well as the many test plots of the Florida state experiment station, have yielded a multiplicity of authentic data about the infant industry, which is scheduled to mature into a very large business.

The United States pays from $15,000,000 to $20,000,000 annually for the insufficient low-quality tung-oil supply available for importation from China. The average market price of the imported oil ranges about 15 cents a pound. There is no telling when war, internal strife or naval embargo may shut off this foreign supply. Our present government policy of preparedness has hatched out the budding Florida industry which promises to flower into a successful agricultural fixture, for it is producing an essential commodity for many long-established enterprises.

A tung-oil grove yields some merchantable return the third season, while the fourth year it is old enough to bear a profitable commercial crop. The trees, which will grow to a height of twenty-five feet or higher, produce oil nuts profitably for three decades or longer. They are not injured by the frosts which occur in northern Florida. After his grove comes into bearing, the grower should realize a net return of from $75 to $100 an acre, and when the trees are fully mature, this income may be proportionately higher. The milling results demonstrate the extraction of approximately four and a half gallons of oil from 100 pounds of hulled nuts. The average mature tree will produce from fifteen to twenty pounds of oil annually, while some of the experimental trees have yielded thirty pounds apiece.

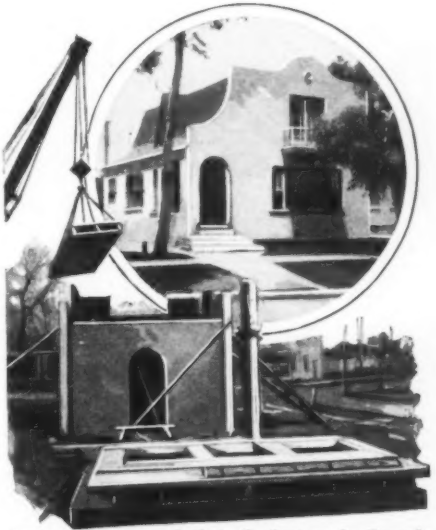
The Tung-Oil Nuts Range from Two and a Half to Three Inches in Diameter and Produce the Finest Drying Oil Known to Science; Paint Factories Consume Vast Quantities

The imported tung oil is dark in color and contains from five to eight per cent of free acid. Its quality lacks uniformity and its adulteration is so uncertain that American manufacturers refuse to accept any of the imported oil until they have made complete chemical and physical tests of the product. Yet even this poor grade of tung oil, previous to the inception of the new Florida industry, resulted in the manufacture of better waterproof paint and varnishes than could be made from any other known oil. The Chinaman waterproofs his home, boats, clothing, his masonry, silk, paper and other products with this oil. He uses it in soap manufacture, he burns it as an efficient illuminant and also employs it in making India or indelible ink.

Oil mills will be established potentially throughout the American tung-oil belt, each plant being large enough to handle the nut crop from 6,000 acres of producing groves. The goal of the American tung-oil industry, which is now off to a good start among our new enterprises, is the ultimate establishment of 300,000 acres of bearing groves. It will require this acreage to provide enough domestic tung oil annually to satisfy our present and future needs. Science is even now seeking new uses for the superior grade of tung oil which can be milled in this country and which is far superior to any ever imported from the Orient.

COMIC FIGURE ON STREET SIGN HELPS DIRECT WAY

Citizens of St. Johns, Oreg., have found a way to make their street signs more effective and, at the same time, to spread good humor, by attaching comic figures of animals and other designs to the street nameplates. They are distinctly patterned and help the stranger to fix the location of a certain street in his mind.

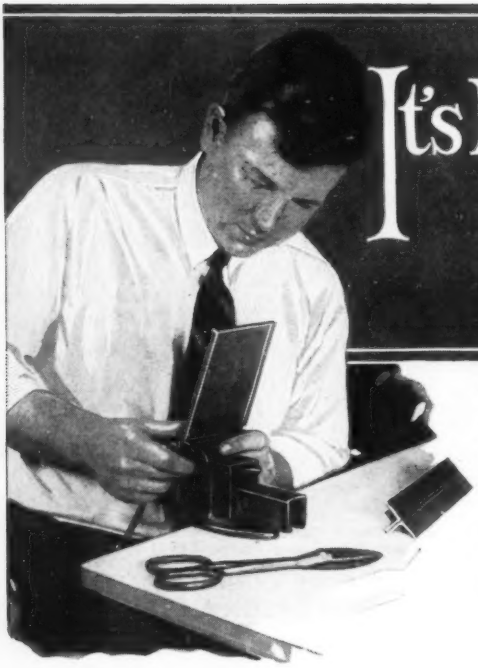


Assembling a House Built in Sections on the Ground; Door and Window Frames Are Molded in Place

PRE-CAST CONCRETE HOMES SAVE LABOR AND FORMS

A new method of building concrete houses and other structures has been developed and patented by a San Antonio, Tex., structural engineer. He casts walls, floors and ceilings in sections, in flat molds lying on the ground, and then joins the parts by hoisting them into place with a small crane. Each part, in addition to adequate steel reinforcing, has an air chamber running the full length, giving two walls with a sound-deadening air space between, which also cuts down the transmission of heat. The chief feature of the process, however, is the elimination of the use of form lumber in which to cast the parts and the reduction in labor. Flat metal or metal-covered wooden bases are laid on the ground and adjustable metal forms assembled on them. All door and window frames are set in place and cast into the parts. It takes about ten minutes to arrange a form and place a door or window frame. One foreman and four common laborers with a small concrete mixer can turn out 1,200 square feet of wall in eight hours. As the sections are assembled, the reinforcing bars interlock, and the opening is filled in with grout to make a continuous surface.

It's Easy to Make Stage



Above, Bending the Short Edges of the Can Top in the Vise; Below, Laying Out Stock

IN THE old days when radio was young —that is, five or six years ago—three tubes were alleged to be sufficient to get coast-to-coast reception, and a few turns of wire around an oatmeal box gave the thrill of radio to untold hundreds.

Today, what with one thing and another, a radio set has to be pretty good to find its way around through the crowded ether. With the addition of various stages of r.f. amplification, and latterly the screen-grid tube, it is imperative that the stages be shielded from one another, not only to prevent interstage coupling, but to minimize the pick-up capacity of the coils and wiring from the signals of powerful local broadcasting stations. Even sets that were built in the days when a kilowatt was "some power" for a broadcasting station, can be improved by putting the r.f. coils in cans or shields.

A few short years ago, radio engineers were discussing the impossibility of more than two stages of radio amplification. Today, few sets are built with less than three; there is no novelty to sets having as many as four, and the discussion as to the practical limit of r.f. stages seems to have come to an end.

Every builder of radio sets knows, at any rate, that if the product of his skill is

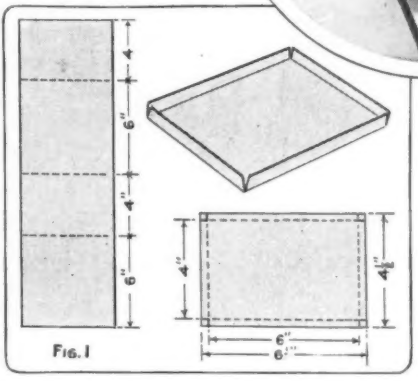


FIG. 1

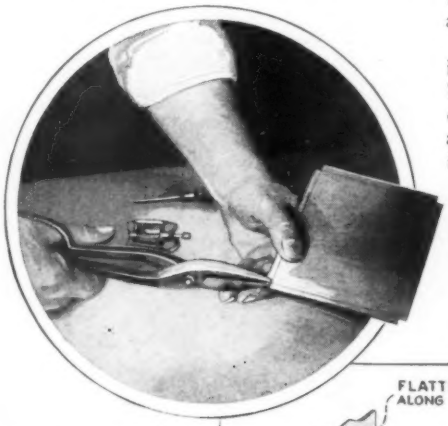
Your Own Shields

by J. S. Hagans

Right, Soldering Corner of Can in Angle-Iron Fixture; Below, Cutting Out Corners of Top

to step out, get distance and keep the various broadcasts apart, he will be required to separate each stage from its neighbor, regardless of whether he uses screen-grid tubes or uses a.c. or d.c. for his supply.

While stage shields can be bought ready-made in standard sizes, the builder sometimes encounters a condition where some special dimension is needed, and it may be a problem to him how to make it, if he does not care to order it from a tinsmith, or wants to do the job himself. In fact, there is no reason why he should not make all the shielding he needs. This article will tell how.



Various materials are used for shielding purposes, with aluminum, copper and brass, the price running down in the order given, the most common. Sheet aluminum is favored by manufacturers in spite of its high cost, but for the set builder it suffers from the disadvantage of being difficult to solder; in fact, ordinary soldering is impossible with aluminum. The retail price of the metal is usually somewhere around $1 a pound, although that is discounted somewhat by the fact that the metal is lighter than copper or brass. Copper comes next in price, and although it might seem that it should cost less than brass, such is not the case. Brass, which is an alloy of copper and zinc, contains less copper and therefore costs less.

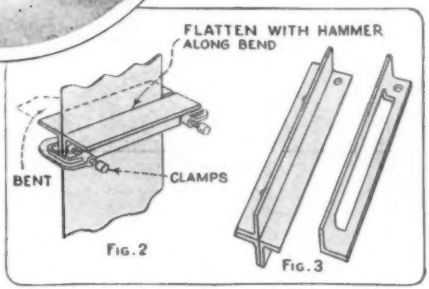


FIG. 2

FIG. 3

Sheet brass, which comes in long rolls,

about 1 ft. wide, should be obtainable almost anywhere for something under 50 cents a pound. There are four kinds of sheet brass that can be had, classified according to their temper, as soft, half-hard, hard and spring; for the present purpose the half-hard is recommended.

If your dealer is equipped with modern devices for slitting sheet metal cleanly and accurately, it will be advisable for you to figure the number of feet you will require, remembering that it comes in 12-in. rolls, and have him slit the stock. If you can buy the material and get it cut, you will have two 6-in. strips of any length you want up to 100 ft. Six inches is just about the right height for a shield, and, assuming that the average panel is 7 in. high, there is thus liberal allowance for a baseboard and subpanel wiring, the wires entering through the bottoms of the shields, which are permanently fastened to the base with screws.

Left, Bending Long Edge of Top in Angle-Iron Clamp; Below, Assembling Soldering Fixture

The only tools required are a scriber, square (combination preferred), tin snips, hammer, a few short pieces of 1-in. angle iron, four small C-clamps, and a pair of good iron carriage-makers' clamps. A vise is handy, but not absolutely necessary, as the angle iron and clamps can be made to take its place.

It is well to consider making the shield in three separate pieces for convenience, not only in manufacture but also later on when the set is being assembled. This will mean that the top and bottom are separate from the can proper, and isn't as hard to do as it sounds.

The first thing to do is to straighten and lay out the stock. Taking as an example the building of a shield 4 by 6 in., and, of course, 6 in. high, go about the business as shown in Fig. 1. Each side will be 6 in. long and each end 4 in. wide, and the sum of measurements is 20 in., so that much stock is cut off; or, better, lay out the whole thing so that any errors in measurement can be corrected before it is severed from the piece. In the diagram, the long section (Fig. 1) forms the sides, and the short ones the ends, and these are marked off with the square and scriber.

The next thing is to place the strip between two pieces of angle iron (Fig. 2), along one of the scribed lines. The angles are fastened together securely with the carriage clamps, and the brass is bent over to make as nearly as possible a right angle; this you will find more or less impossible by mere bending. In order to get a square corner, it will be quite necessary to use either a hammer, or, what is to be greatly preferred, a wooden mallet, to flatten down the angle. An ordinary hammer can be used, of course, but owing to the small face, it is likely to leave ugly marks on the metal.

When all three bends have thus been made, there is just one soldered joint to make, at the last corner, and this is likely to be harder than anything else if you are to avoid burned fingers and do a nice job. Fig. 3

shows a simple fixture that is made by fastening three short pieces of angle iron together with machine screws, in such a way as to make a fairly accurate right angle on one of the four sides. By inserting the open ends into this angle and clamping with another angle through which a slot has been cut for the soldering bit, no difficulty will be experienced in holding them.

The soldering job finished, the can is laid aside and the top and bottom are turned out.

Two pieces of brass are required, each 4½ by 6½ in., which, it will be noted, is ½ in. greater in each direction than the area of the can. The stock is flattened; then all lines should be accurately laid out with the square and followed in cutting. The two pieces thus obtained are laid out ¼ in. from each edge after the manner shown in Fig. 1, whereupon the square sections indicated at the corners are cut out with the point of the snips. The edges are then turned over along the scribed lines in exactly the same way the can was formed. If a vise is available, the angle-iron guides and work can be held between the vise jaws, the pieces of iron functioning as a pair of false jaws; this applies to the long dimension. If there is no vise, two pieces of angle iron must be cut to the exact length of the shield and the clamps used as a substitute. If a vise is used, the short ends can be turned over by merely inserting the stock between the jaws, tightening the vise and bending, repeating the operation as many times as necessary, according to the width of the vise jaws and the work in hand. The same method can be applied to turning over the long edges, but it is preferable to use the angle-iron clamps, as there is then no risk of putting one or more crimps into what should be a neat, square edge.

The Completed Shield, Made in Half an Hour, Ready for the Set

After both top and bottom pieces have been formed, a small triangular piece is snipped out of each corner, as shown in the view of the complete top, Fig. 1. The edges then can be turned in slightly past the right angle, to make a somewhat closer fit around the can and prevent it from jarring out of place or rattling. In general, it is well to be liberal in the dimensions of your shields and arrange the coils contained therein to be as far removed from the metal walls as you possibly can.

If a single large shield is desired instead of a number of individual units, the difficulties are somewhat greater, but by no means serious if care is used. The individual stages can then be separated from each other by partitions soldered in place. The difficulties to be met with in this case are only those incident to handling the larger work, otherwise the method is exactly the same.

Any bulge in the completed shield can easily be shaped up by bending with the hands, but even this is usually unnecessary when top and bottom are in place.

Homemade Battery Cable

A length of rubber tubing, large enough to cover six or seven flexible insulated wires, makes a serviceable battery cable. A stiff wire is run through the tubing, the leads are fastened to the end of the wire and pulled through until all are in position. The leads should extend about 8 in. from each end of the tubing. The rubber covering also protects the wires from battery acid and accidental fraying.—Robert J. Williams, Chicago.

Speaker Employs Laminated Diaphragm

Something radically new in radio loud speakers, claimed to cover the entire scale

Inventor Displaying Laminated Diaphragm and Two Cone Speakers Fitted with the New Device

of voice and musical frequencies without distortion or suppression, has been introduced by a Washington inventor, Mr. E. L. Rice. His device consists of a pile of laminated diaphragms of varying diameters which are fastened to the apex of the conventional cone speaker.

Aids to Better Tone Quality

There are a few simple aids to better tone quality that any radio owner can try if he is dissatisfied with the tone of his receiver. Regardless of the type of audio amplifier employed, it is always possible to alter the tone quality somewhat, to suit the individual. Almost any audio amplifier may be improved by placing a high resistance across the secondary of the first a.f. transformer. The value of this resistance will range between 100,000 ohms and 1 megohm, the best value being found by trial.

The detector gridleak has some bearing on tone quality, and a variable type can be used and adjusted to suit the particular requirements of the set and local conditions. The output from a power tube should be transferred to the loud speaker by means of a suitable filter, such as an output transformer or a condenser-choke combination.

The next step is to filter out as much of the higher frequencies as seems necessary, to obtain the desired mellow tone. This must not be carried too far, however, as many of the higher frequencies are necessary to give sparkle and detail to speech, but a happy medium should be obtained where such high frequencies will not interfere with the quality of orchestral music. Most audio amplifiers and loud speakers have the necessary higher frequencies to begin with; therefore, the problem is to control them. This may be done with by-pass condensers connected across the loud-speaker terminals, to shunt out the higher frequencies. A .01-mfd. mica condenser may be used for this purpose, and a second condenser of the same capacity, added in parallel, will still further modify the tone. Since, for speeches and long-distance signals, sharpness is required, while, for orchestra and other musical programs, mellowness is sought, a variable tone-and-volume control is preferable. Volume controls of the table type are now available, and when used in combination with a .25-mfd. condenser across the speaker terminals, the operator has under his control a device which acts much in the same manner as the soft pedal of the piano.

Tone quality is also a matter of loud-speaker location. Try the speaker in various parts of the room or house, until the best place is found. Wherever possible, put it in the next room to the listeners.

FOR THE RADIO BUILDER

The blueprints below include the best of Popular Mechanics tested circuits. When ordering, simply quote numbers of blueprints desired and inclose proper amount addressed to Popular Mechanics Magazine, Radio Dept., 200 E. Ontario St., Chicago, Ill. Magazines containing full descriptions of the circuits can be obtained. Send 25 cents for each magazine desired, giving date of publication.

No. 111, Homemade Tube Tester July 1926 . . 25c
No. 115, 15 to 550-Meter Three-Tube Receiver . . . . . Nov. 1926 . . 25c
No. 116, Three-Tube Loop Set . Dec. 1926 . . 25c
No. 123, Economy-Nine Super-heterodyne . . . . . Nov. 1927 . . 50c
No. 130, One-Tube Short-Wave Adapter . . . . . Mar. 1928 . . 25c
No. 134, Edison Type B-Battery July 1928 . . 25c
No. 138, Screen-Grid Perfect-Tone Six Receiver . . . . Nov. 1928 . . 25c
No. 139, Simple Television Receiver . . . . . Dec. 1928 . . 25c
No. 140, Power Amplifier and B-supply for Television . . Jan. 1929 . . 25c
No. 142, Two-Tube Screen-Grid Short-Wave Adapter . . Mar. 1929 . . 25c
No. 143, Four-Tube Screen-Grid Receiver . . . . . May 1929 . . 25c

Speaker Stand has Battery Compartment

by Edwin M. Love

THE SPEAKER stand illustrated here is a compact piece of furniture that will prove an ornament in a room, standing either against a side wall or in a spare corner. The drum at the top provides space for a cone speaker, while the base houses the batteries. The construction is so simple that no difficulty in the building will be experienced. The design is especially adapted for polychromic treatment with lacquer or paint, either over the smooth wood, or on gesso grounding.

For the column, glue together two thicknesses of 2 by 4-in. stock, 3 ft. 6 in. long. Join the sap sides straight and smooth, with the centers slightly hollowing, so that the clamps, bearing in the center, can force the surfaces together throughout. Plow a ⅜ by ¼-in. groove down the middle of each, so that the wire can be fished through the column. Close the ends with glued-in plugs, to give bearings for the lathe centers.

Clamping the Column Pieces Together; Note the Groove for the Speaker Wires

When dry, center the stick accurately, and turn off the corners of the column at slow speed with a gouge. The rest of the turning can be done at fairly high speed. Work down the profile of the column approximately to shape, using the gouge, and finish off with a skew chisel and sandpaper. If the stand is to be gessoed, fine sanding is not necessary. The total length of the column is 3 ft. 4⅜ in. A 1½-in. dowel, ¾ in. long, is turned on the upper end, and one 1¾ in. long on the lower.

Make a cardboard pattern for the front of the base, copying the profile of one-half by drawing 1-in. squares and sketching the outline. Trace the pattern on a piece of three-ply ⅜-in. stock, and cut out with turning saw or keyhole saw. Smooth the cut-out portion with a wood file and sandpaper.

The back of the base is the same shape outside as the front, but the cut-out section is arched to a plain curve at

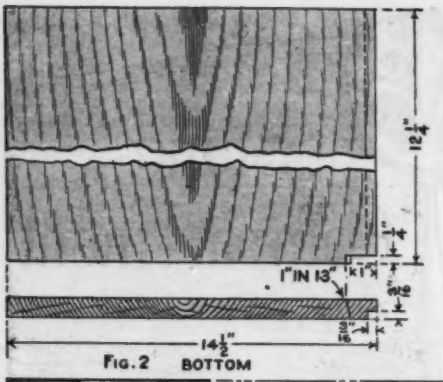
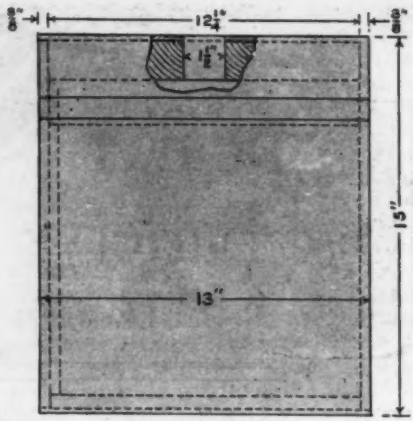
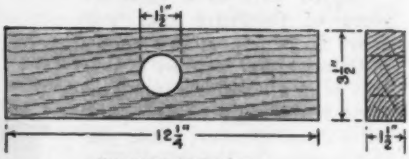


FIG. 2 BOTTOM



SIDE OF BASE



COLUMN SUPPORT
FIG. 3

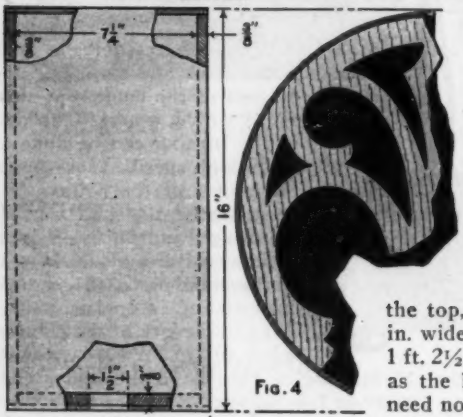
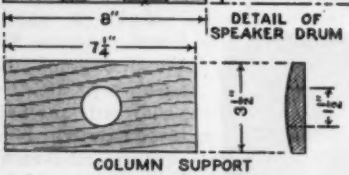


FIG. 4



DETAIL OF SPEAKER DRUM

COLUMN SUPPORT

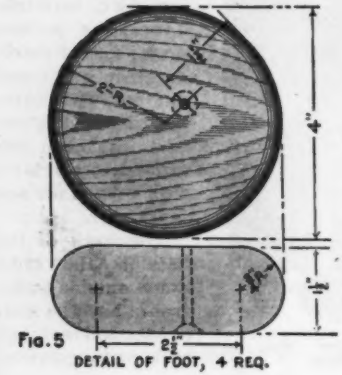


FIG. 5
DETAIL OF FOOT, 4 REQ.

the top, rising 13 in. from the bottom and 12½ in. wide at the top. At the bottom, the legs are 1 ft. 2½ in. apart. The bottom of the base serves as the lower rail. Since the back is hidden, it need not be carefully smoothed.

The base bottom, Fig. 2, is a simple rectangle of 1-in. stock, 12¼ in. by 1 ft. 2½ in., with the back edge notched ¼ by 1 in., the shoulders sloping 1 in. in 13 in., to fit the back. Rabbet the ends on the underside 3/16 by ¼ in., to carry the edges of the side veneer.

Glue and nail the lower edges of the base and back to the bottom, spacing the upper edges with a stick tacked to them. Then cover the sides with 3/16-in. stuff, planed to thickness from ⅜-in. resawed stock, or ripped direct from 1-in. material. Cut pieces, 13¼ in. long, and apply with the grain running from front to back. If water is sponged freely on one side, the veneer will curl toward the dry side, and can be bent easily around the curves. Glue and nail with 1-in. brads. Glue the joining edges. When dry, trim the projecting ends flush with the front and back.

For the column support, cut a piece of 2 by 4-in. stock 12¼ in. long. In the center, bore a hole, 1½ in. in diameter, to fit the lower end of the column. Glue and nail this between the base front and back, at the top, before adding the top

Tracing Front-Base Pattern

Warping Veneer with Water

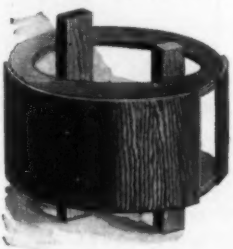
sheathing, and surface the upper side to fit the curve.

The grill of the speaker drum is 15⅝ in. in diameter. For the half-pattern, divide the space into 12 equal sectors, and scribe circles with radii increasing successively 1 in. Cover the grill with fine brass-wire mesh, or with silk, stretching it tight and holding it with light cleats on the back.

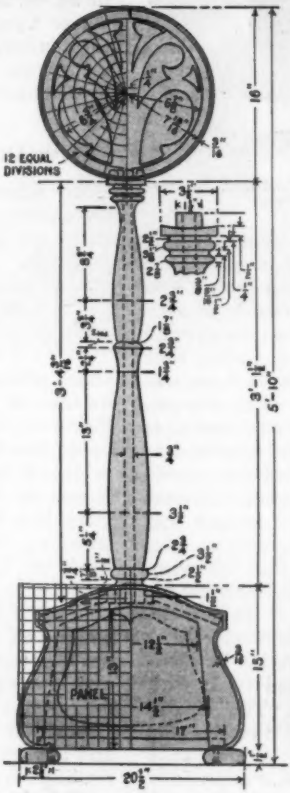
Cover the sides with 3/16-in. stock, in the same way as the base. The upper column support is ¾ by 3½ by 7¼ in., and rounded on one face to fit inside the drum.

In assembling the base and speaker drum with the column, fit the column shoulders to the curves, and when the glue is dry, reinforce the top of the base with pieces of 1-in. stock, cut between the column support and the sides of the base; then nail carefully from both the front and the back.

Inside the base front, glue a piece of three-ply wood, or wallboard, as a panel. The back need not be closed, but if it is desired to keep the dust from the batteries, slip a piece of cardboard inside. Leave the back of the speaker drum open.



Speaker Drum Partly Built



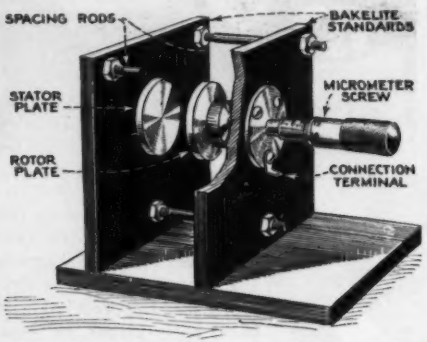
Dimensioned Layout of Stand

Base Ready for Veneer

The four feet (Fig. 5) are 1½ in. thick and 2 in. in diameter, with the edges turned to semicircular profiles. Bore one or two screw holes through each, and glue and screw them to the base. If there are any open joints, fill them with plastic wood. For a smooth paint finish, sand with No. 00 grit, but for a texture finish, this is unnecessary.

Making a Calibrated Standard Condenser

One of the most important pieces of equipment for the radio experimenter and

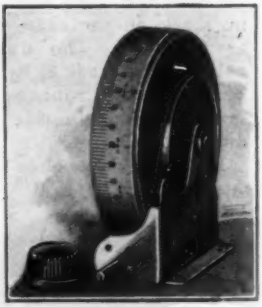


Homemade Calibrated Standard Condenser, Showing the Construction in Detail

engineer is a standard condenser. The illustration shows one that can be made by anyone familiar with good tools. The constructional details are clearly shown. The faces of the plates must be ground smooth and parallel, and the spacing rods must be carefully adjusted so that the micrometer screw reads zero when the two plates are in contact. The micrometer is a standard type that may be obtained at any hardware store. The bakelite standards are cut from 3/16-in. material or thicker if possible, as they must be rugged and capable of holding the adjustment over long periods; any material that will warp is, of course, unsuitable. The terminal for the moving plate is at the front and the terminal for the fixed plate is connected at the rear. The capacity is varied by moving the rotor plate back and forth with respect to the stator plate. The separation of the plates may be directly read from the micrometer screw, the capacity is calculated for different separations and the calibration curve drawn. To find the capacity of each setting, multiply the area of one plate in square inches by 2,248. Multiply the distance between plates, in inches, by 10,000. Divide the first figure by the second, and the quotient is the capacity in mmfd. For example, the capacity for a separation of 1 cm. (.3937 in.) and a plate area of 1.5 sq. in. is .856 mmfd. Knowing this factor, it is merely necessary to divide this figure by any other separation in centimeters in order to determine the capacity for that separation. Using a standard micrometer screw, it is possible to get a capacity range from .65 to 11 mmfd., with plates of this size. Ranges above and below this may be obtained with larger or smaller plates. Three corresponding areas and diameters that may be employed are as follows: area in sq. in. .5, diameter in inches .798; area in sq. in. 1.49, diameter in inches 1.3816; area in sq. in. 2.63, diameter in inches 1.8306. These figures will save time and enable the builder to construct three sets of plates that will cover all practical ranges for standard condensers of this type.

New Drum Dial Is Easily Mounted

An illuminated drum dial of center-drive construction, which may be mounted either on the sub or front panel, is now available. The illustration shows the assembly as well as the mechanical arrangement of the parts, the driving unit being positive without backlash or slippage. There is a screw take-up on the side of the disk for tightening the cable and two screws in the main hub for fastening the dial to the condenser shaft. The bracket is very simple and is designed for either base or panel mounting. The scale readings are supplied either with graduations from 0 to 100 and approximate corresponding kilocycle readings, or with kilocycle readings only, from 1,500 to 550.



REMOVE THREE SCREWS AND FILTER CONTROL KNOB
PLACE DETECTOR TUBE FROM SET HERE
REMOVING DETECTOR TUBE
BACK PLATE REMOVED
INSERTING CONVERTER PLUG IN DETECTOR TUBE SOCKET
PLUG IN COIL ON THE BACK
CONNECT ANTENNA HERE
SIDE VIEW

Short-Wave Adapter for A.C. Sets

A one-tube short-wave adapter for use in conjunction with an a.c. receiver is now available. The manufacturer claims to have eliminated the difficulties involved, and the filament (or heater) cathode, plate and ground connections are brought to the unit through the plug, which is inserted in the detector-tube socket. The detector tube is then placed in the socket of the adapter unit as shown. The antenna must be disconnected from the receiver and connected to a post at the rear of the short-wave unit. One feature of the adapter is a filter-control knob in the rear, which is designed to eliminate "motorboating," and once this control is properly set, it need not be varied. Three plug-in coils are employed to cover all waves from 26.2 to 90 meters; the same antenna inductance is used for each coil, as it is variable.

Turn Off Set When Changing Tubes

Be sure to turn off the set before changing tubes. Many of us have had the unpleasant experience of inserting a new tube in our receiver only to have a brilliant flash and a ruined tube. This is often blamed on the tube, although it may not be the cause at all, especially if the set is on when the change is made. The real reason generally lies in the fact that the tube is inserted at an angle, causing the plate prong of the tube to make contact before the grid prong. If the current is on, an excessive plate current is passed, without the restraining influence of the necessary grid bias. This applies to all of the tubes but is particularly true of power tubes, which employ considerable plate current under normal conditions and enormous current when operating without a grid bias.

Helpful Radio

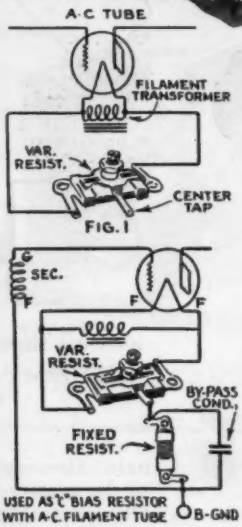
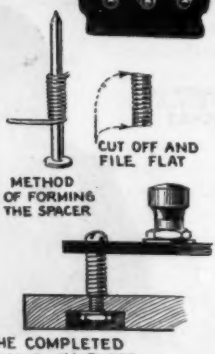
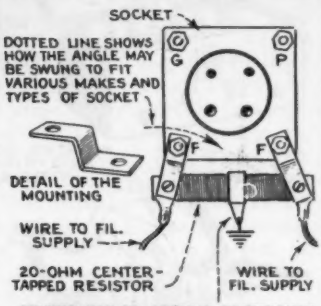


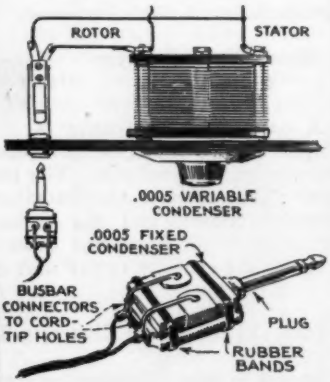
Fig. 1, New Variable Center-Tapped Resistance Replaces Center Tap on Transformer, to Balance Out Hum; Lower Diagram Shows the Method of Obtaining C-Bias



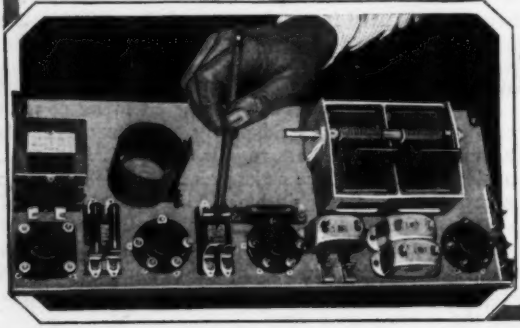
Above, Handy Spacing Bushings for Raising Terminal Strips, or for Similar Uses, Are Made from Round Busbar Wire Compactly Wound around a Nail of Sufficient Diameter to Pass the Screw; Below, Small Blocking Condensers Provided with Suitable Lugs for the Grid and Plate Posts of Resistance-Coupling Mounts Are Now on the Market


SOCKET
DOTTED LINE SHOWS HOW THE ANGLE MAY BE SWUNG TO FIT VARIOUS MAKES AND TYPES OF SOCKET
G
P
F
F
DETAIL OF THE MOUNTING
WIRE TO FIL. SUPPLY
20-OHM CENTER-TAPPED RESISTOR
WIRE TO FIL. SUPPLY
CENTER TAP TO GROUND OR THROUGH BIAS RESISTOR TO GROUND AS THE CASE MAY BE

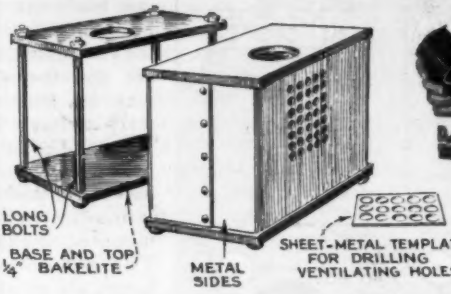
Above, a Simple Mounting for Center-Tapped Resistors Which Places the Hum-Control Device as Near the Tube Filament as Possible



Above, a Plug-In Device, Consisting of a Fixed Condenser Mounted on a Phone Plug, That Increases the Capacity of a Variable Condenser When Connected in Parallel as Shown; for Example, If the Variable Is .0005 and the Fixed Condenser the Same Value, the Total Capacity Will Be .001 Mfd.

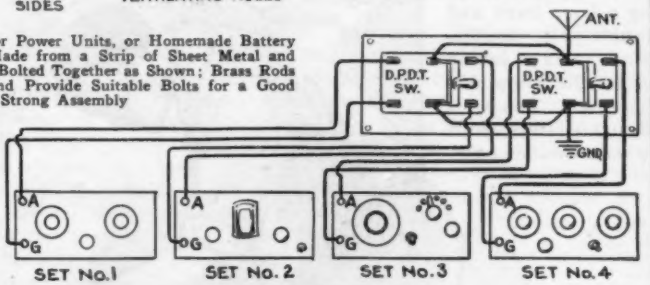


Hints from Experts

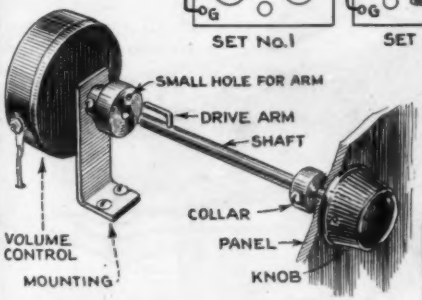


Above, When Laying Out a Receiver, Arrange the Coils, Tubes and Condensers for Shortest Possible Leads

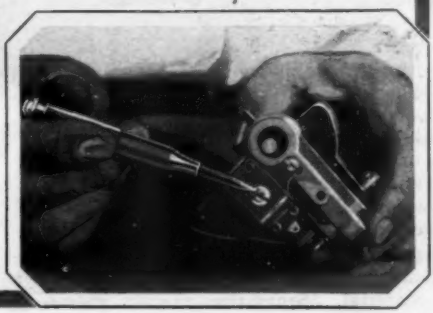
Above, a Container for Power Units, or Homemade Battery Chargers, May Be Made from a Strip of Sheet Metal and Two Bakelite Panels, Bolted Together as Shown; Brass Rods Threaded at Each End Provide Suitable Bolts for a Good Strong Assembly



Above, Two D. P. D. T. Switches, Arranged to Provide Handy Antenna and Ground Connections for Demonstrating Several Receivers; Below, a Small Balancing Condenser May Be Connected Directly across a Large Variable for Equalizing the Units of a Ganged Assembly for Single-Dial Control

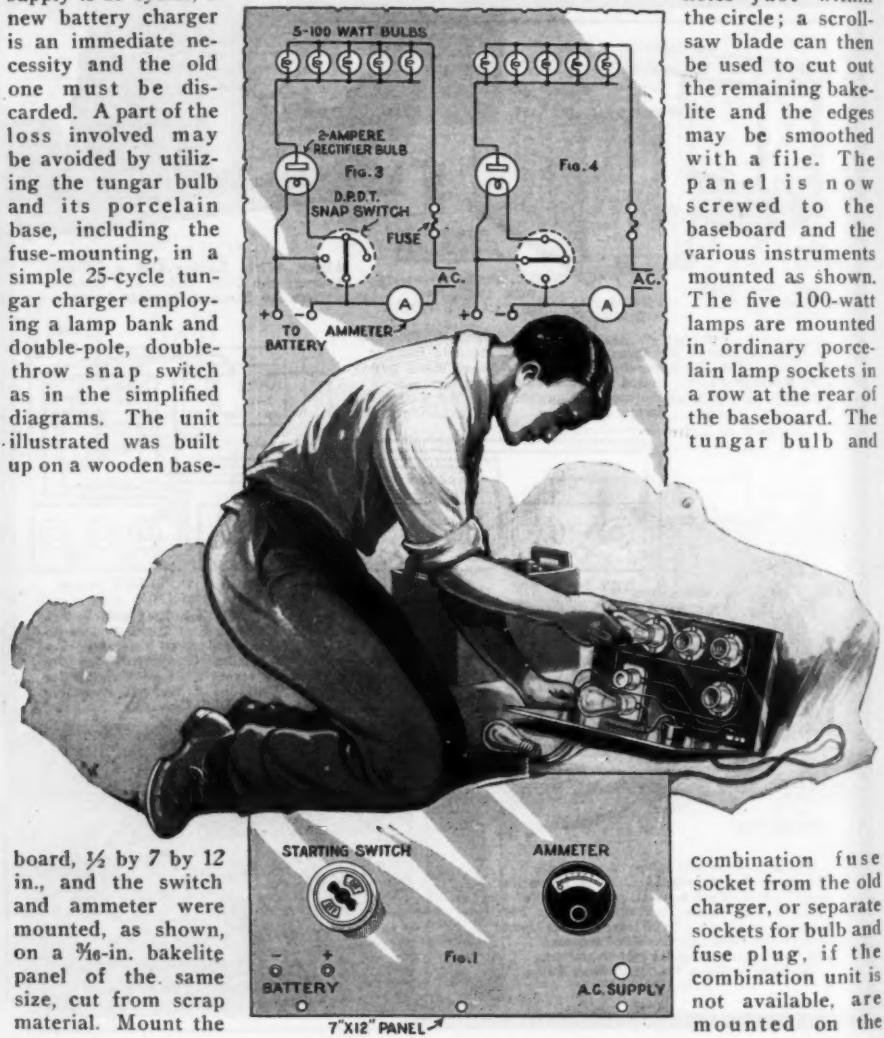


Above, a Convenient Method of Mounting Volume-Control Resistors, Condensers, or Similar Parts, Where Space Is Limited, or for Electrical Reasons Such as the Prevention of Hand Capacity; the Collar Is Obtained from an Old Rheostat, and the Original Knob on the Unit Is Drilled to Take the Shaft and Drive Arm



Tungar Charger for 25-Cycle Supply

A 2-amp. tungar charger that will work on a 110-volt 25-cycle supply may be easily assembled from parts salvaged from a 60-cycle charger of the same type, or the parts for the entire unit may be purchased from any electrical-supply house at small cost. In most communities the 110-volt 60-cycle current is supplied, but, if the radio owner moves to a locality where the supply is 25 cycles, a new battery charger is an immediate necessity and the old one must be discarded. A part of the loss involved may be avoided by utilizing the tungar bulb and its porcelain base, including the fuse-mounting, in a simple 25-cycle tungar charger employing a lamp bank and double-pole, double-throw snap switch as in the simplified diagrams. The unit illustrated was built up on a wooden base-board, ½ by 7 by 12 in., and the switch and ammeter were mounted, as shown, on a 3/16-in. bakelite panel of the same size, cut from scrap material. Mount the starting switch at the left and the ammeter at the right; two 5/16-in. holes are drilled in the lower left-hand side of the panel for the battery wires and a ½-in. hole at the lower right for the lamp cord, as shown in Figs. 1 and 2. An inexpensive ammeter of the auto-dashboard type was used by the writer, and the mounting hole in the panel was cut with an extension bit. If such a tool is not at hand, scribe a circle of the size required and drill a series of small holes just within the circle; a scroll-saw blade can then be used to cut out the remaining bakelite and the edges may be smoothed with a file. The panel is now screwed to the baseboard and the various instruments mounted as shown. The five 100-watt lamps are mounted in ordinary porcelain lamp sockets in a row at the rear of the baseboard. The tungar bulb and combination fuse socket from the old charger, or separate sockets for bulb and fuse plug, if the combination unit is not available, are mounted on the



baseboard at the left, as shown in Fig. 2. The wiring diagram, Fig. 3, shows the off-position in which the switch must be when the charger is started. Fig. 4 shows the on-position to which it is turned for the actual charging operation. The only difference between this charger and the ordinary tungar type is the starting switch which passes the battery current through the rectifier bulb, thus putting it in operation. To charge a storage battery, connect clips to the two battery leads, the positive clip going to the positive terminal and the other clip to the negative. The charger is then connected to the 25-cycle house-lighting supply in an ordinary lamp socket. Now, before turning on this current, turn the snap switch on the charger to the off-position, as in Fig. 3, and turn on the supply current. The battery current will start the bulb operating, and as soon as it is in operation, immediately snap the charger switch to the on-position. The five 100-watt lamps act as a line resistance and the fuse, which is a 6-amp. type, will protect the device in case

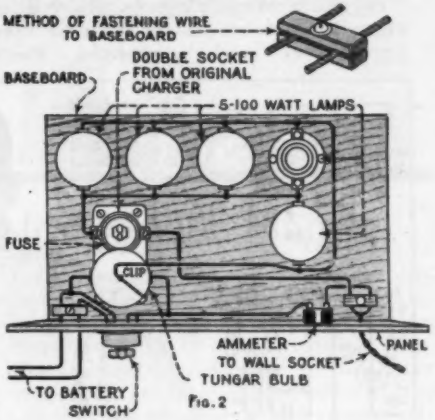
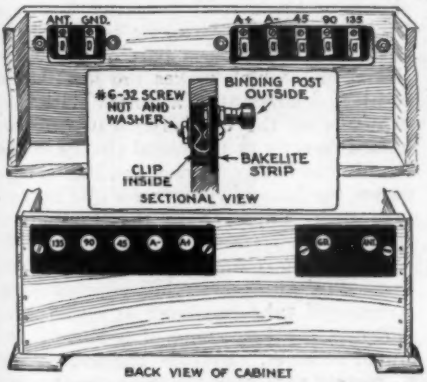


Fig. 2

any error has been made in the wiring, or from surges in the supply line.—F. Cieslewicz, Buffalo, N. Y.

Dustproof Terminal Strip for Cabinet

When the various battery, antenna and ground leads are brought out through large holes in the rear of the cabinet, dust easily enters and finds its way to the instruments, where it causes trouble. A simple way to avoid this and at the same time make the receiver connections easily accessible is shown in the illustration. Two openings in the rear of the cabinet are cut and covered on the outside with strips of bakelite. These strips are drilled for the various binding posts, the posts and Fahnstock clips being mounted as shown in the sectional diagram and the strips screwed in position on the outside of the cabinet. If the subpanel clears the back of the cabinet ¾ in., the set can be lifted out of the cabinet without removing the strips. All connections to the set are made inside of the cabinet to the clips.



Arrangement of Connections for the Various Leads of a Set, Which Make It Dustproof

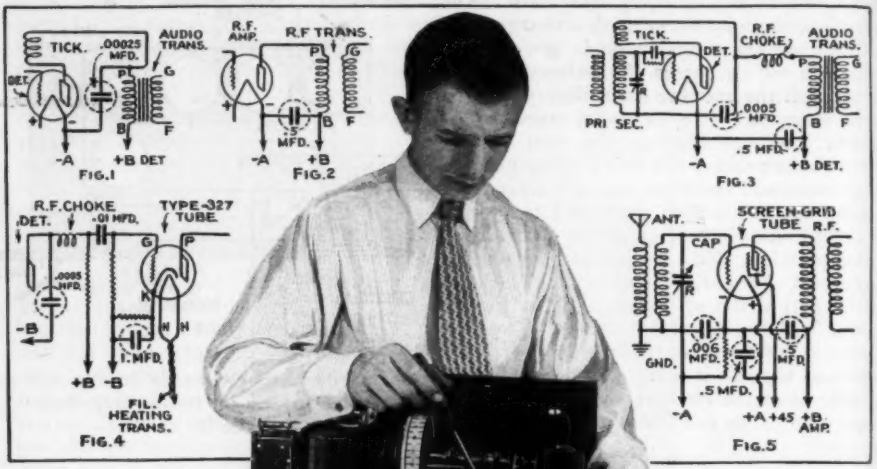
Simple Regeneration Control

An easy method of controlling regeneration or feedback is to vary the negative bias on the grid of the r.f. tube. Increasing the bias on the tube, making it more negative, results in a drop in the mutual conductance and increases the plate resistance. This has the effect of reducing the flow of current in the plate circuit and checks the feedback to a point well within control. The method does not result in broad tuning.

¶Popular Mechanics' radio department offers its information service free to all readers of our magazine. We will be glad to help you with your problems, and will promptly answer all inquiries.

Locating By-Pass Condensers

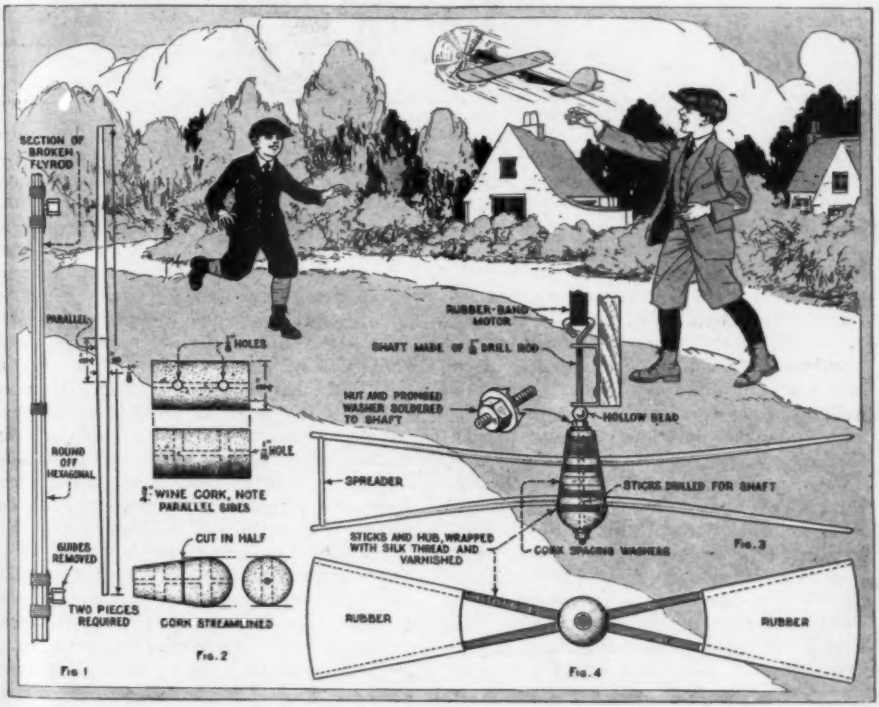
There are several places in any receiver where by-pass condensers must be used if good results are to be expected. These by-pass condensers are often omitted by the builder, with the result that the set squeals and he will complain that the designer has brought out a defective circuit. Or frequently the builder will put in condensers of different values than those specified, and in this case also his reception will be anything but what it should be. In practically all circuits, a by-pass condenser is necessary across the primary of the first audio transformer, and in cases where transformer amplification is not used, the condenser should be placed across the resistance or impedance in the detector-plate circuit. Fig. 1 gives the location of this condenser, which should not be larger than .001 mfd.; a .00025-mfd. condenser is usually sufficient. The duty of this by-pass condenser is to return the r.f. currents to the filament, keeping them out of the B-supply. In an r.f. amplifier, as in Fig. 2, stable operation may be obtained by the use of a fairly large by-pass condenser in the position shown. This condenser returns the r.f. currents to the filament without passing them through the B-battery and connecting leads. If this by-pass condenser is omitted, the set will quite likely be unstable, owing to coupling between the leads and will be difficult to neutralize. Fig. 3 shows a detector and first audio stage by-passed to keep the r.f. current out of the a.f. transformer primary, and the a.f. current out of the high-resistance B-battery or B-power unit. The addition of the r.f. choke, in this diagram, is essential for maximum results. The same arrangement is shown in Fig. 4, as applied to an a.c. set. Here the positive lead to the detector-plate resistor is not shown by-passed, but it should be by-passed to negative B with a .5-mfd. condenser. In an a.c. set, the metal chassis of the set is a part of the negative-B line, which makes the installation of by-pass condensers a simple matter, as one side of the condenser can be connected directly to the metal chassis. The 1-mfd. condenser shown in Fig. 4 bypasses the biasing resistor for the heater-type tube employed in the first audio stage. This method of obtaining the C-bias is now in common use and very effective. Fig. 5 shows the popular new screen-grid tube employed as an r.f. amplifier in the first stage of a battery-operated receiver. By-pass condensers are absolutely necessary for this type of tube, which must also be carefully shielded.

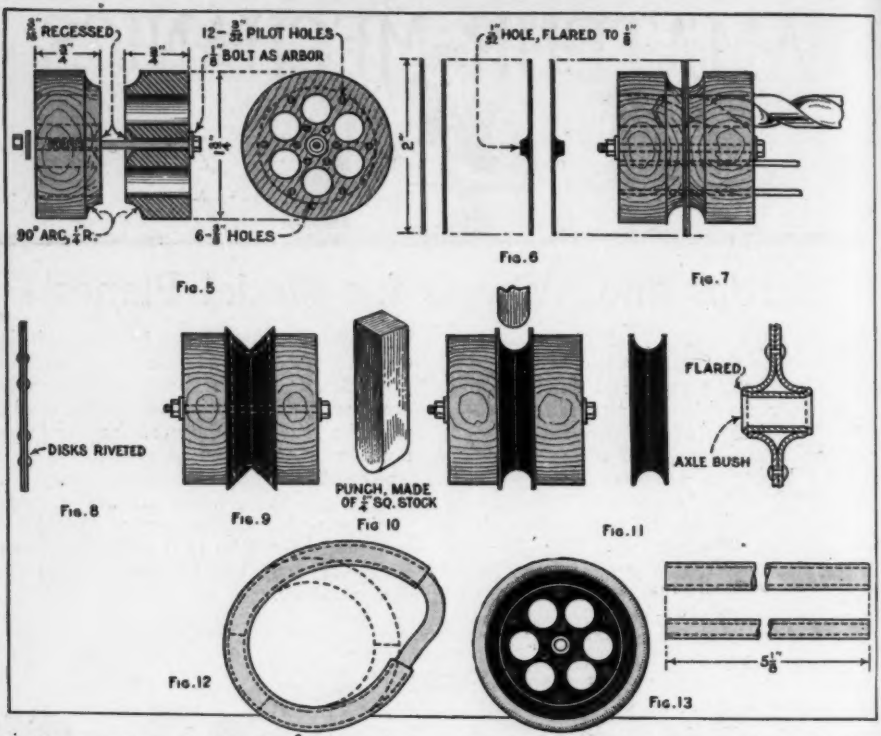


AMATEUR MECHANICS

Props and Wheels for Model Planes

BUILDERS of model planes usually have to do a lot of experimenting before finding the prop best suited to any particular model, as many factors enter into the design of the propeller: speed, thrust, area, capacity of the rubber-band motor, etc. The propeller shown in Figs. 1 to 4 has an advantage over the ordinary form in that it may be adjusted to suit a wide range of conditions. This form of prop has remarkable strength and lightness, and will stand considerable knocking around without being broken and distorted. While the sketch shows an 8-in. propeller, the same construction can be employed for a 10 or 12-in. stick, except that the longer sticks used for the latter must have less taper. A propeller of this type can be used purely as an experimental model, and then, when the proper area, pitch, etc., for any particular model has been determined by trial and adjustment, a regular prop can be carved from the data obtained.



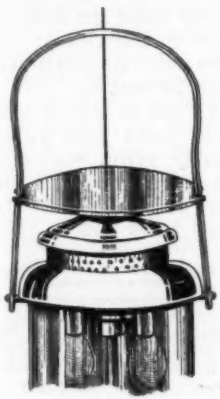


The drawings are largely self-explanatory. The frame of the propeller consists of two sticks, each made from an old section of fly rod, Fig. 1. The guides, of course, are discarded, and the hexagonal rod scraped down to form a round section, 8 in. long and ⅛ in. in diameter in the center. The center section should be parallel for ¾ in. The hub is a parallel-sided wine cork, ¾ in. in diameter, drilled and streamlined as in Fig. 2 and then cut in half. The next step is to make a propeller shaft, of drill rod or music wire, to suit the plane, and long enough to pass through the hub and its spacing washers. The wire is threaded a little more than the entire length of the hub, and provided with a couple of nuts. Fit a stick in each half of the hub, bolt together, heat in an oven to soften the glue in the rod slightly, then spread the ends of the sticks about ½ in., holding them with a spreader, as in Fig. 3, until the sticks have taken a permanent set. Now cement on pieces of thin rubber, taken from a toy balloon, to form the blades, or use pockets of oiled silk for the same purpose. To change the pitch of the propeller, thick or thin spacing washers of cork are used between the halves of the hub, and altering the angular positions of the sticks changes the area of the blades. It is necessary, of course, to change the rubber for each change in area, but this is a job of only a few moments, far shorter than the time required to carve a new prop from wood.

Wheels for model planes can be purchased from quite a number of model-supply houses, but many builders of models prefer to make their own. If one has a lathe, the work is simplified, but even without one, perfect wheels can be turned out once the original form has been made, and any woodturning shop will do this for a few cents. Figs. 5 to 13 show the sequence of operations, and are also self-explanatory. The wheels shown are for large-size scale models; for lighter, smaller craft, use lighter-gauge aluminum stock and smaller rubber tubing. Use

only thin-walled Para tubing for the tires, not the red, ribbed kind. Para tubing can be purchased from a store selling surgical instruments and hospital supplies. Fig. 5 shows the form for the wheel disks, made of clear maple, and mounted on a ⅛-in. bolt. The wheel disks, Fig. 6, are cut from 24-gauge sheet aluminum; a 1/32-in. hole is drilled in the center, and this is flared with a punch until the hole is ⅛ in. in finished size. Two disks are clamped between the halves of the form, and the ⅜ and 3/32-in. holes drilled through them as in Fig. 7. The disks are then removed and riveted together, Fig. 8, replaced in the form and the lips spread with a knife blade, Fig. 9, and finally rounded with a round-nose punch, ¼ in. wide, as in Fig. 10. The next operation is to fit and flare the axle bush, Fig. 11. The bushing is made of ⅛-in. aluminum tubing, and may be flared with a center punch. The tire, Figs. 12 and 13, is made of two pieces of Para tubing, one ¼ in. in diameter and the other 5/32 in. The inside of the larger tube and the outside of the smaller are cleaned with gasoline, then the smaller one is coated with rubber cement and slipped inside the larger, continuing to feed the tube in until the ends of the larger tube meet.

Heat Guard for Lantern Handle



When a lantern of gasoline type is suspended for a length of time, the handle becomes unbearably hot. This can be prevented by providing a sheet-metal guard as shown in the drawing. The guard deflects the better part of the heat and keeps the handle cool enough for comfortable carrying.

Old Range Boiler Adapted for Use in Boy Scouts' Camp for Furnishing Hot Water

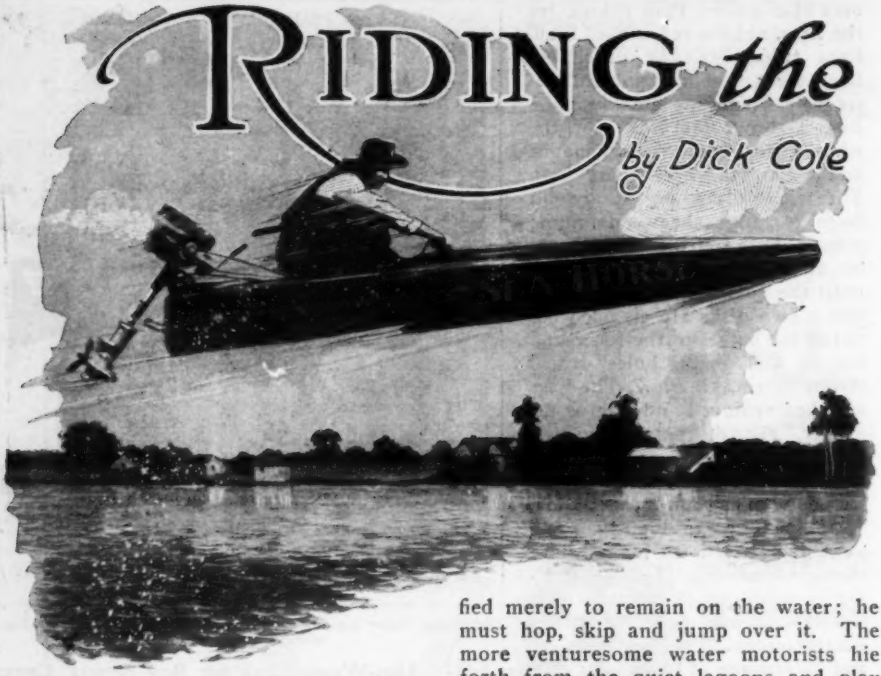
Hot-Water Tank for Boy Scouts' Camp

An old range boiler, connected to a stove, as shown in the accompanying illustration, was found highly useful at a boy scouts' camp. Ordinary ¾-in. pipe was used for connections from the stove to the center and lower holes of the tank, a tee, two nipples and a faucet being fitted to the center opening. Both lengths of pipe were run horizontally through the firepot of the stove, one above the other, and were connected by means of a return U. The rivets holding the top end of the tank were chiseled off so that the top could be removed easily to permit filling the tank. A block of wood or piece of cork floating in the tank, and a string connecting it to a counterbalancing weight on the outside, as shown, furnish a means of gauging the height of the water. The outfit furnished plenty of warm water whenever needed.

¶ Dirt smudges, pencil marks, etc., can be readily removed from tracing cloth by a cotton swab soaked in benzine; it may be rubbed freely over the ink lines or water colors without risk of dissolving them.

RIDING the

by Dick Cole



THERE was a time when the outboard motorist was quite satisfied to chug along at eight or ten miles an hour on the serene surface of a river, an inland lake or a sheltered bayou. Boating was a romantic pastime, and serenity and quietude were deemed essential to give the true "local color" touch.

But no longer is the outboarder satisfied merely to remain on the water; he must hop, skip and jump over it. The more venturesome water motorists hie forth from the quiet lagoons and play leapfrog with the waves in the open waters. The romantic pastime has become thrilling and spectacular.

The fundamental reason for this change is the improvement in boat design and more powerful motors. A few years ago outboard motors were designed to fit on a boat; now boats are especially designed to fit the motors. The result is the high-speed, outboard-driven craft of today. Forty miles an hour is now commonplace; the mile-a-minute craft will soon be with us.

To ride in one of these little boats and jump nimbly from wave to wave, gives one an unforgetable thrill. On large lakes and in tidal

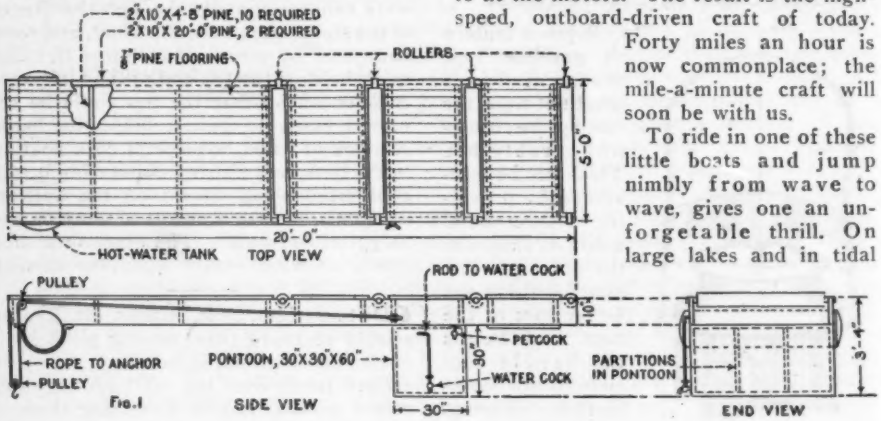


Fig. 1

"FLYING FISH"

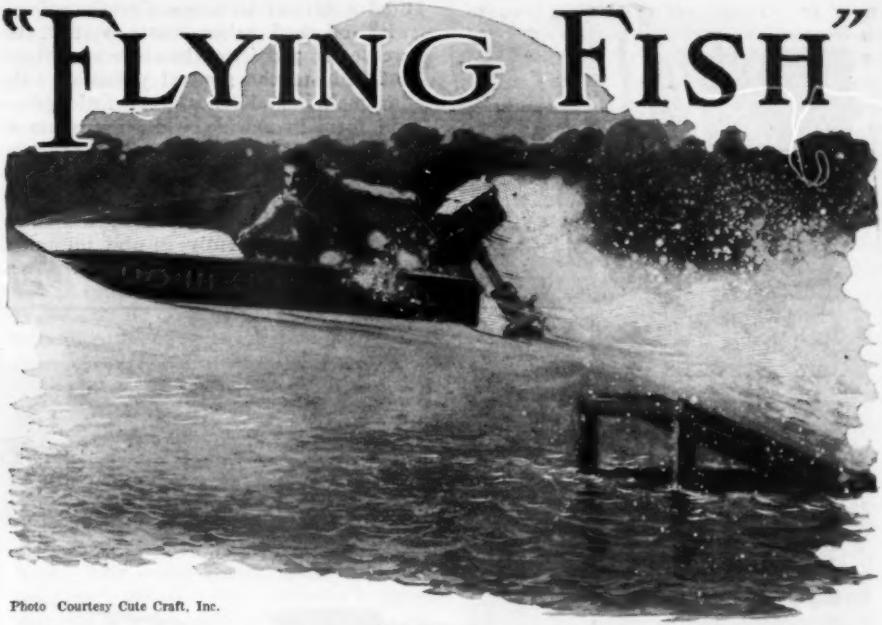


Photo Courtesy Cute Craft, Inc.

waters the little outboards truly disport themselves like flying fish, but on quieter water mechanical means must be employed to bring about the same thrilling results. So the boats, traveling at high speed, are run up greased skidways and catapult themselves through space for 30 or 40 ft. The thrill experienced by a ride down the amusement-park water toboggan is tame compared with the thrill of a ride in a leaping "putt-putt."

At the present time, leaping boats figure at many outboard regattas, but only as an added spectacular performance to thrill the onlookers. So universal has this sport become, that undoubtedly high and broad-jumping competitive contests will be added to the official program at forthcoming meets. From all over the country come urgent inquiries as to how to jump a putt-putt. So this article will be a guide for future contestants in this new field of sport.

The first requisite for jumping is a skidway. Of course, any inclined plane rising out of the water will serve, in a haphazard manner, as a take-off platform. However, boats of varying design and

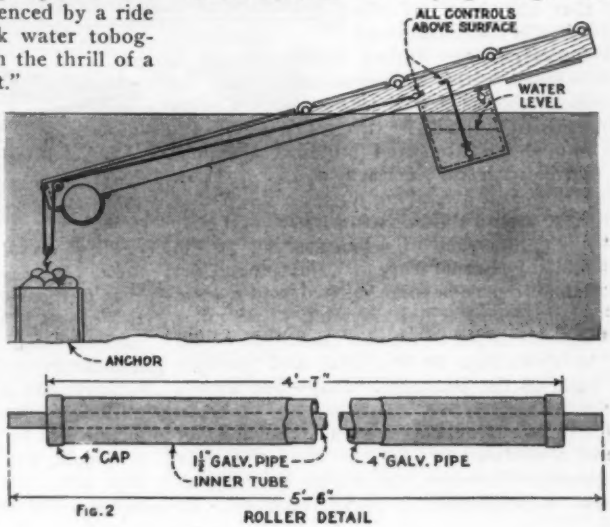
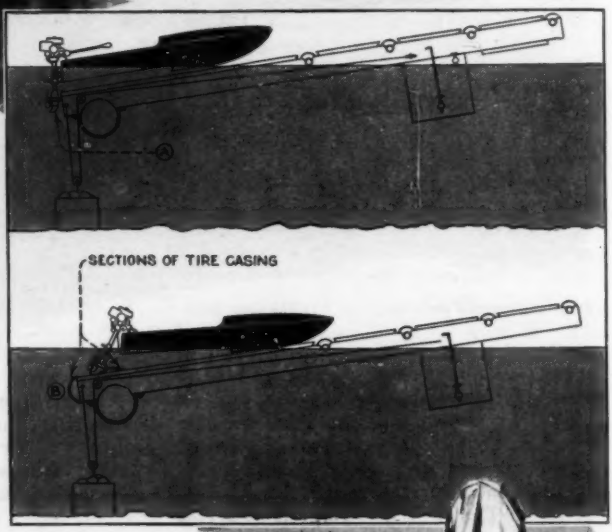


Fig. 2 ROLLER DETAIL

speed require a different angle of inclination to display best their leaping prowess. In fact, an incline that might be ideal for one type of boat traveling at 30 miles an hour, would throw another type traveling at 35 miles into a "tailspin." So it is best when planning a take-off skidway, to design one that is adjustable to various heights. One must consider, too, that the level of the water in many lakes and rivers changes during the season, so a skidway anchored permanently may be unsuitable at certain times. Such a skidway can be made by driving two-by-fours into the bottom and building a framework with an inclined platform upon them. But great care must be taken that there are no rigid obstructions that a boat might hit, head on, when rushing up the skidway preparatory to jumping. An amateur may become excited, and a little misjudgment when traveling at 35 miles an hour might result in a crash that would be disastrous to the boat and possibly fatal to the occupant. Play—but always play safe.

It is customary to grease the flooring of a skidway so that the boat will slide easily. However, the use of grease may be objectionable in some localities. In tidal water, or in rivers already polluted with oil and other waste matter, the grease scraped from the skidway will add but little to the general pollution. But on small inland lakes, very little grease will form in a wide, iridescent scum on the surface of the water. This probably will arouse the ire of the permanent summer cottagers.

Competitive jumping contests are bound to figure prominently in the outboard-motor field in the future. So it is well



Photos Courtesy Roy D. Chapin

that outboarders begin practicing. With this object in view, it is suggested that the outboard fans in a district join and build a community skidway.

There are many ways of building such a skidway, but the one described in this article will be found very satisfactory. It is simple, and can be built very cheaply. Not only does it afford every jumping facility, but embodies the safety element

as well. If a jumper becomes excited, he may miss the skidway altogether. Or, at the worst, he will only slide off the side and possibly get an unwelcome bath.

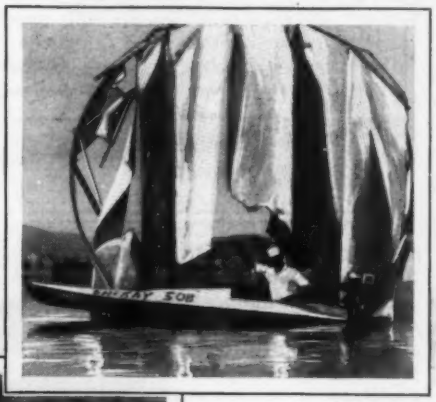
Fig. 1 should give the prospective builder a clear insight into the nature of the construction. Minor changes can be made to meet individual conditions. This skidway is designed for boats where the total weight of boat, motor and operator does not exceed 500 lb.

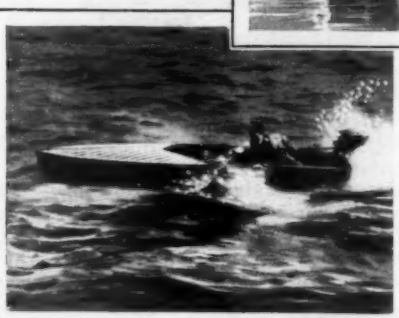
The front, or take-off end, of the skidway is supported on a square pontoon, 30 by 30 by 60 in. Of course, a cylindrical pontoon of equal cubic content could be used as well. But a square one is much easier to make and fits better into the general assembly. Constructional details of the pontoon are not given. It is only a leak-proof box with two partitions inside, to prevent the sudden shifting of the water ballast.

The height of the take-off edge is regulated by the amount of ballast in the pontoon. The water enters through an underwater valve. An ordinary faucet screwed into the wood will serve. An extension rod is attached to the faucet handle so that it can be opened or closed from the surface.

An air valve is necessary in the top of the pontoon. An ordinary petcock will serve the purpose. Of course, the air valve must be opened when water is admitted to the pontoon. To expel the water, an automobile tire pump is attached to the petcock. A large-barrel quick-acting pump can be used, as high pressure is not necessary to force water from the pontoon. When the pontoon is filled, the platform will be only a few inches above the water. Should one desire to lower the skidway still more, it will be necessary to fasten weights under the platform.

The wooden constructional material will give the rear end of the skidway a certain amount of inherent buoyancy. It is better to increase the buoyancy by placing an old hot-water tank under the end. The tank needs no valves or pipe fittings, but should, of course, be leak-proof. The end of the skidway is drawn under the water to any desired depth by means of a rope-and-pulley arrangement attached to improvised anchors. Wooden boxes or crates of about ½-cu. yd. capacity, filled with rocks, will serve as anchors. Means must be provided for attaching a pulley. The ropes are led to convenient cleats above the waterline. By adjusting the ropes, and by means of the water ballast in the front pontoon, any height and angle of incline can be arranged. The use of the hot-water tank under the rear end of the skidway is not absolutely essential, but it is recom-





Photos Courtesy Evinrude Motor Co.

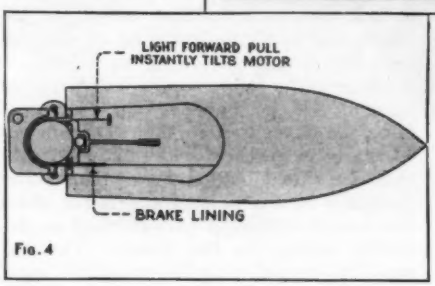
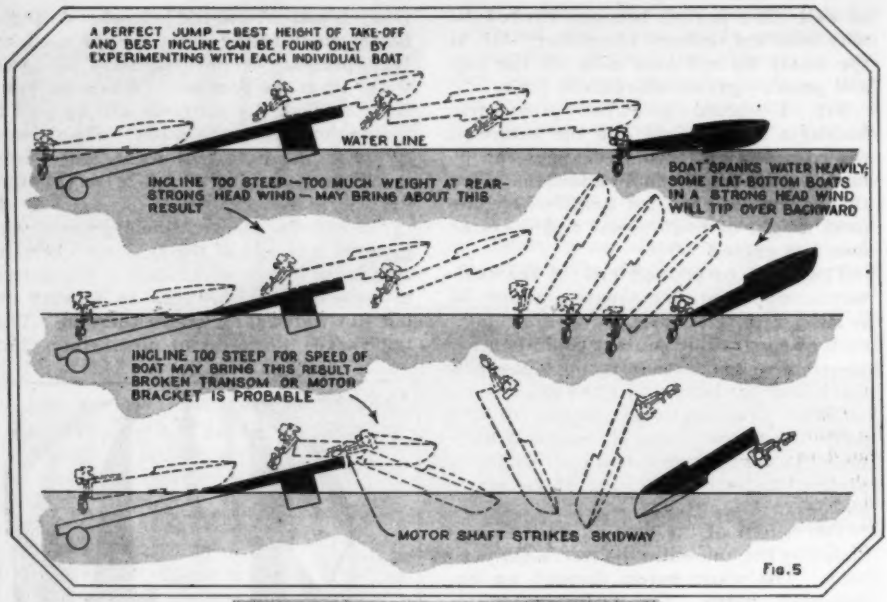


Fig. 4


A PERFECT JUMP — BEST HEIGHT OF TAKE-OFF AND BEST INCLINE CAN BE FOUND ONLY BY EXPERIMENTING WITH EACH INDIVIDUAL BOAT
WATER LINE
INCLINE TOO STEEP—TOO MUCH WEIGHT AT REAR—STRONG HEAD WIND—MAY BRING ABOUT THIS RESULT
BOAT SPANKS WATER HEAVILY; SOME FLAT-BOTTOM BOATS IN A STRONG HEAD WIND WILL TIP OVER BACKWARD
INCLINE TOO STEEP FOR SPEED OF BOAT MAY BRING THIS RESULT—BROKEN TRANSOM OR MOTOR BRACKET IS PROBABLE
MOTOR SHAFT STRIKES SKIDWAY
Fig. 5

mended. The added buoyancy puts a greater strain upon the anchor ropes and holds the raft more rigidly in any position.

Mention was made that the use of grease was sometimes objectionable. Rollers are used on this skidway instead of a greased surface. Four rollers at the forward end are sufficient. These are made of 5-ft. lengths of 4-in. iron pipe. Galvanized pipe is best. The ends of the pipes are capped with 4-in. to 1½-in. reduction caps, from which the inner threads have been machined out so as to permit the free entry of a length of 1½-in. pipe, which serves as an axle. The use of the rollers is so intermittent that accurate bushes for the axle are not necessary.

The rollers are covered with lengths of discarded inner tubes of suitable size to slip over the pipes. Four or five tubes can be slipped one over the other, to increase the cushioning effect.

The first time an outboarder rushes onto the skidway at 30 miles an hour, he

will probably experience that sensation referred to as "having one's heart in one's throat." To safeguard the first jumping venture from mishap, the take-off edge of the skidway should be as low as possible, and the incline as gentle as is practical. However, the rear end must be sufficiently submerged so that the driveshaft housing of the motor cannot possibly strike squarely against the edge. Fig. 3, at A, illustrates this point.

Before attempting the jump, the cross bolt in the stern bracket, which permits the motor to tilt up, must be loosened so that the motor can swing up freely. It is best—and a longer or higher jump can be made—if the motor is raised manually from the water the moment the front end of the boat touches the skidway. To do this, an extension handle can be bolted vertically to any part of the motor above the stern bracket. A forward pull on this handle swings up the motor. The moment the propeller comes out of the water

the normal load is off the motor, and it will race, unless the spark is retarded. It is a simple matter to attach a string or wire to the spark lever so that it will be thrown into "retard" position coincidentally with the raising of the motor.

It is better for the amateur merely to retard the spark the moment the boat hits the skidway and permit the flooring to raise the motor. No damage will result from this course, providing the housing does not strike squarely against the end. As an added safeguard, it is well to nail a section of old tire casing across the end and also on the flooring. (See Fig. 3, B.)

After the first jump has been successfully performed, slightly elevate the take-off edge and try again. Repeat the performance time and again until you have found the angle and elevation most suitable to your boat. A series of drawings, Fig. 5, show dangers that must be avoided. Not only must the height of the take-off and the angle of incline be considered, but also the effect of a head wind and the distribution of weight in the boat itself. No fixed rules can be laid down to conform to all boats. The point of maximum jumping efficiency can be determined only by experiments.

Unquestionably, jumping contests will soon be a feature of outboard regattas. When competition is keen, the winner will probably be he who uses the full thrusting power of his propeller to the last inch and then quickly "snaps" his motor out of the water. The writer has found a very simple and positive means of doing this. Lengths of rope are attached to the ends of a piece of brake lining the width of the flywheel. The lining is placed loosely around the flywheel. The end of the rope against the direction of revolution is made secure to some rigid part of the boat. The other end is held in the hand. A slight pull on the rope brings the brake lining against the face of the flywheel, and the propeller is instantly raised out of the water. See Fig. 4. As the motor tilts up, the brake lining slips off the flywheel. But the desired act has been accomplished. A string attached to the spark lever retards the spark at the same time.

Holder for Making Portraits of Sitting Baby

Portraits of the baby in a sitting posture can be readily taken while the baby is still too weak to sit up, by the use of the holder shown in the drawing. It consists merely of a 9 by 5-in. base of 1-in. wood, a back rest of the same thickness, hinged to the base, and a wide cloth band to go around the baby's body just under the arms. The baby's clothes are easily disposed so as to hide the whole arrangement.

This Device Holds the Baby in a Sitting Posture and Prevents It from Tipping While Mother Takes Its Picture

Novel Weather Vane Consisting of a Windmill Which Actuates Figure of Farmer Hoeing

Animated Weather Vane

The photo shows a novel weather vane mounted on the roof of a farmer's barn in Connecticut. It consists of a four-blade propeller connected to a figure of a farmer holding a hoe. Rotation of the propeller causes a realistic movement of the hoe. The figure of the farmer and the part representing the ground are cut out of ½-in. wood. The arms are pivoted at the shoulders and a small hoe is attached to the hands as indicated. A small screw-eye is driven into the rear arm at the elbow to receive one end of a wire connecting rod, the other end of which is pivoted eccentrically to the center boss of the propeller. The frame consists of two lengths of 1 by ½-in. wood and two lengths of strap iron, bent, drilled and fastened to the underside of the base. The holes in the strap-iron supports serve as bearings for a vertical shaft on which the vane turns.

Wall Size That Will Not Sour

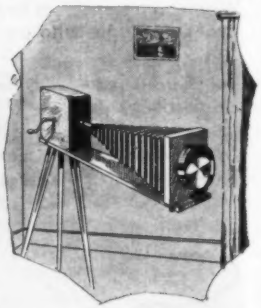
Wall size that will not sour can be made in the following way: Soak 1 lb. of glue in water overnight. Add 2 gal. of boiling water and then ½ gal. of wood alcohol. Stir the mixture well. Another advantage of this size is that it can be applied over any wall paper and, after it has thoroughly dried, the paper can be varnished without risk of ruining the job.

Refinishing Old Golf Balls

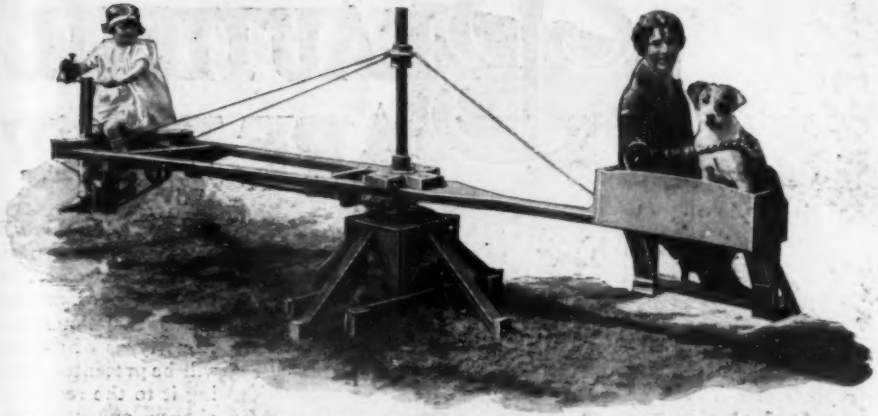
When my golf balls lose their whiteness, I refinish them by immersing them in a can of golf-ball paint or ordinary white enamel. To do this, each ball is suspended from a thread about 15 in. long, with a pin attached to hold the ball. The can of paint is raised until the ball is entirely submerged, after which the can is lowered and held under the ball until the surplus paint runs off.—August Jeffers, Bedford, Ind.

Combination Lens for Camera

Amateur movie-camera owners can make a combination vignetter and telephoto-lens carrier in the following way: Construct a sheet-metal holder or base to carry an old camera bellows of cone shape, the latter being used to hold an anastigmat lens from a hand camera. The lens should be of about 5-in. focus and should have a large opening of the iris diaphragm. With a sliding movement, the lens will be a good substitute for a telephoto lens when set at the proper distance from the camera. By unscrewing both lenses, the iris diaphragm can be used as a dissolver when completing or beginning a scene. This attachment can also be used for double exposures, with masks for blocking out one or more sections of the view, and it will form a very efficient lens shield. The lens fitted to the camera must be removed when using the larger one as a telephoto.



¶A small bottle of ammonia is often useful on a desk; one dip and a little rubbing make the pen as bright as new.



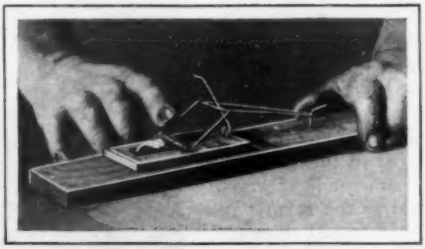
Homemade Merry-Go-Round, Driven by Means of a Pedal Arrangement Similar to That of a Bicycle, Affords the Youngsters Plenty of Wholesome Exercise besides the Thrill of Rapid Motion

This Merry-Go-Round Is Pedal-Propelled

The photo shows a pedal-driven merry-go-round, built by a Chicago man for his youngsters. The parts used in the construction of this device were obtained from the junk pile, with the exception of the lumber, and the cost of this was very slight. The driving mechanism operates exactly as that of a bicycle, and by using it, the children get plenty of wholesome exercise plus enjoyment.—Paul Garvey, Chicago.

Safety Catch for Mousetrap

Many housewives dislike setting the mousetrap because the trap may spring prematurely and hit the fingers. The photo shows a method of setting such a trap in absolute safety. Get a piece of flat wood, a nail and a length of cord. Nail the trap to the board and tie the string to the spring as indicated. Then drive a nail into the board behind the trap and bend it over. When setting the trap, turn the nail around and hook the string over it, a loop being tied in the string for this purpose. There should be enough play to allow the spring to lift slightly so that it can readily be seen when the trap is properly set. After this has been done, carry the trap to the spot where the rodent is likely to be caught, and turn the nail around so that the string will slip off when the trap is sprung.—Nellie May Moore, Hamilton, Ont.

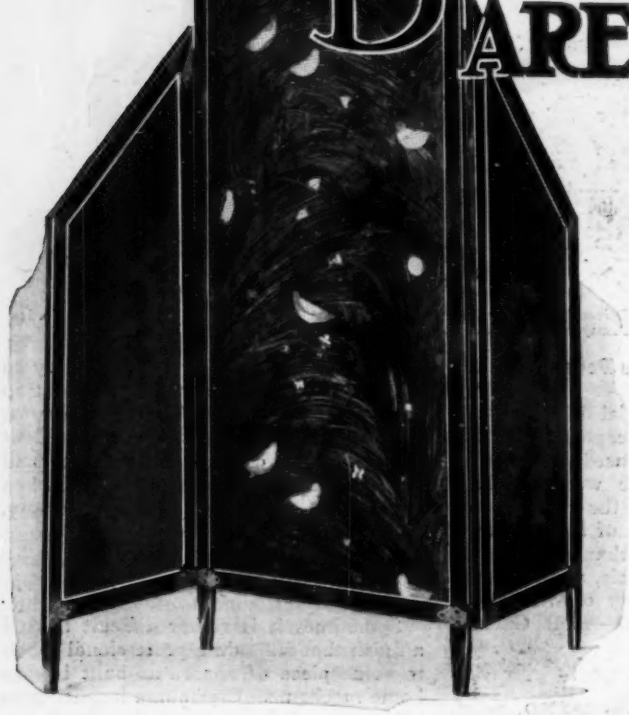


How to Prevent a Mousetrap from Snapping on Your Fingers in Setting It

Homemade Crystalline Lacquer

Sometimes it is rather difficult to find a finish that will add a professional touch to some piece of apparatus built by the home mechanic. Crystalline lacquer provides a good finish but it is not always obtainable. However, a good substitute can readily be made. Take a can of ordinary brushing lacquer of any standard make, and dissolve it in some naphthalene crystals, which you can get at any drug store. The quantity of crystals may be determined by trying the lacquer on a piece of scrap sheet metal. The more naphthalene you use, the better and more pronounced will be the crystalline effect. The lacquer may be of any color and may be either brushed or sprayed on wood and metal surfaces. The finish is durable.

BEAUTIFUL ARE EASY



By E. R. HAAN

PART I

YOUR living room can be greatly improved by an easily made screen. Besides its utility, which is apparent to every home owner, such a screen has considerable decorative value, and many an otherwise commonplace room can be given a pleasing touch by the bright colors of the screen. The cost is very small compared with the cost of the ready-made product. After a careful canvas of commercial screens, ranging in price from $50 to $100, it was found that the cost of the material used for a number of homemade screens, which were just as good as the former in every respect, was only $8 to $20, depending on the nature of the material. For the home owner who has some spare time and a few tools, it will be quite a saving, then, to make his own. In this series of articles the construction of various types of screens will be presented, leaving it to the reader to choose one that appeals to him.

The fabric-covered type is especially easy to make as the frame does not have to be rabbeted, no joinery work is necessary, and the need for painting the exposed wood is also eliminated. The wood found best for making the frame is poplar. A good grade of imitation leather was used to cover the frame, although other fabrics, such as colored burlap, heavy oilcloth or tapestry can be applied in exactly the same way.

SCREENS TO MAKE

Double-acting hinges are used, and brass-head furniture nails add greatly to the finished appearance.

Straight strips of poplar, 1¼ by ¾ in., dressed on all sides, should be used. Get enough of this material for the size screen you wish to make. The three sections may be made of equal size, or the central one may be made a few inches higher, and a little wider, if desired. For the average-size room, a screen having three sections, each of which measures 5 ft. high and 2 ft. wide, outside measurements, has been found satisfactory. It is well to determine what kind of fabric is to be used, and the width of the material, before deciding the exact width of the screen sections, in order to prevent wasting any of the material. For instance, the imitation Spanish leather we have used comes in 52-in. width, which makes it possible to completely cover, without any appreciable waste, both sides of a section 25 in. wide, outside measurement, taking into consideration the thickness of the frame. This width would be too narrow for a wider section.

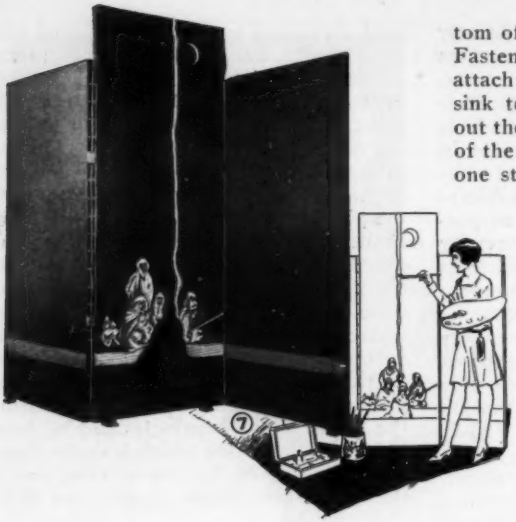
Having determined the size of the sections, the strips are cut into various lengths as follows: six uprights and twelve crosspieces, the latter fitting between the former and being fastened to

them by means of ¼-in. corrugated fasteners, as indicated in the detail below Fig. 2. Drive the fasteners on both sides, to insure a strong joint. Care must, however, be taken in doing this, to avoid splitting the wood. To saw the strips off at right angles is highly essential, and this can be done best by using a miter box, Fig. 1. If none is available, you can readily make one in a few moments by nailing together three pieces of wood to form the bottom and sides of a box that accommodates the strips to be cut. Take a square and mark the top edges and the sides, and then saw carefully. Fig. 2 shows how the pieces of the frame are laid on a smooth floor when nailing them together. As each crosspiece is nailed in place, take a square and check whether it is accurately at right angles, which is necessary in order to make a truly rectangular section. It is, of course, assumed that the frames are dressed before assembling them. If this is not the case, use a small block plane to remove any rough places, which may otherwise show through the fabric. The planing is done before the frames are assembled, to avoid the risk of ruining the cutting edge of the plane if it should make accidental contact with one of the corrugated fasteners. After the frame has been completed, cut off the sharp edges of the frame with the plane so that they will not cut through the fabric, which is possible, especially if imitation leather is used. The corners may be strengthened, as indicated below Fig. 2.

When the frames are ready, the fabric is tacked on. Taking for granted that the fabric is 2 in. wider than double the width of each of the sections so that it can be "wrapped" around the frame, and it is also cut to be 2 in. longer than the section, proceed as follows: Tack one edge of the fabric to one edge of an upright of the frame, as shown in Fig. 3, using small upholsterers' tacks and spacing them approximately 2 in. apart. Be sure to get the edge of the fabric parallel with the edge of the frame, and do not let it overlap at this point. When the entire edge has been tacked on, turn the frame over, grasp the fabric in the center of the opposite side, as shown in Fig. 4, and while stretching it slightly, tack it on. Drive these tacks exactly in the center of the edge, so that they can be covered later by means of imitation-leather gimp, obtainable from an upholsterer or an upholsterers' supply house. Proceed with tacking the fabric from the center toward the ends. Repeat the operation for the other

edge of the fabric, which is tacked directly over the first edge, observing the same precaution to get the tacks in the center. The top and bottom edges are then similarly tacked onto the frame. With a little care, you can avoid getting wrinkles in the fabric. Surplus material at the overlapping edges must be cut off with a safety-razor blade as close to the tacks as possible. The corners are then carefully folded and tacked down so that the folds will be toward the center where the gimp is to be tacked on. Do not stretch the fabric too much and no more at one place than at another. An alternate method of stretching the fabric over the first side of the frames, to insure an even tension at all points, is shown in details A and B, Fig. 5. The first edge of the fabric is tacked to the frame, as described above, and the opposite edge is clamped between two strips of wood. Bring the frame to a vertical position on the lower strip, which is laid on the floor, and pull the frame forward; this will cause the fabric to pull tight and even, permitting it to be tacked down. The covering, in these details, is shown shorter than the frames, for the sake of clearness in the drawing.

The gimp is then applied, the ½-in. width being used for the purpose. It can be had to match the fabric, especially if imitation leather is used. Get metal-head furniture nails, which can be obtained in various shapes, sizes and finishes, for holding the gimp in place and adding a decorative touch. Large flat-head, dull-finish brass nails were used with good results, being driven exactly in the center of the edge of the frame and spaced at 3-in. intervals, which gave the best effect. Do not drive them in with a hammer directly, but use a small block of wood to prevent marring the finish of the nails, as shown in Fig. 6. The best way to apply the gimp is to fasten one end with a nail about 3 in. from a corner. Draw the gimp over the corner, stretch it over the entire edge, draw it over the next corner, and drive in another nail. Mark off the point where the hinges are to be located; it is advisable to use three hinges on each side of the center section. Then mark the position of the nails, spacing them from the edges of the hinges instead of from the center, a mistake which is easily made. The hinges used for the screens are of the double-acting type. Specify the ¾-in. size when purchasing them. If possible, try to get hinges having the same kind of finish as the nails. They are screwed to the center section, care being taken to get them straight, and then the end sections are set next to the center one,



edges on the floor, to permit the hinges to be screwed to the latter. After the sections are hinged together, the screen is complete except for the feet. Ordinary square drawer pulls can be used for this purpose. These are stained to match the general color and shade of the screen. If you have ability to paint, a firelight scene, such as the one shown in Fig. 7, will add considerably to the appearance; if not, a suitable decalcomania transfer can be applied to each side of the center section, to furnish a note of color. When handling the screen, be careful to grasp it by the frame. Never allow the fingers to press into the fabric, as it will stretch, leaving objectionable dents, which cannot be removed easily. Also take care not to push the screen against any object or to push any object against the screen, if you wish to keep it in good condition.

Watering Plants Automatically

I have found that plants can be automatically watered by the wick method when the house is closed for a few days and nobody is around to water them. Just before we leave, the plants are watered thoroughly and a pailful of water is set on a chair near-by so that the pail will be as close to the flowerpots as possible. From a piece of unbleached muslin, tear strips long enough to reach from the bottom of the inside of the pail to each pot. Fasten the strips together at one end and attach them to a weight heavy enough to sink to the bottom of the pail. Spread out the strips of muslin all around the rim of the vessel and lead them to the plants, one strip to each pot, using a nail or a small stone to hold each end firmly against the earth in the pot. In a few minutes, the water will work up the strips and keep the soil in the pots moistened until the pail is empty. The wider the strip is the more water it will carry. Put the pots in dishes to take care of excessive water.—Julia W. Wolfe, New York City.

Gas Saver for Hot-Water Tank

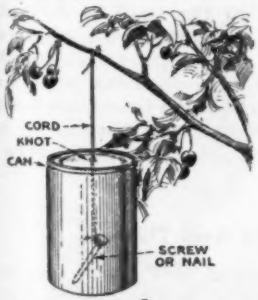
It frequently happens that one forgets to turn off the gas under the hot-water tank with the result that the water may boil, which is not only dangerous but wastes much gas. A device that will shut off the gas automatically when the water in the tank has been heated to a certain depth, will therefore be appreciated. The device consists of a frame wired to the tank, and holding a metal thermostat, which, when heated, trips a weight and turns the gas cock shut. The frame is made of 3/16-in. steel or sheet iron and is bent to form a wide angle. It should be about 12 in. long, and a small pivot hole is drilled 1 in. from each end. Thermostat consists of two strips of aluminum pivoted on the frame and similarly pivoted to each other. A light steel rod is extended from the center pivot

Simple Mechanism Which Shuts Off the Gas under Water Tank Automatically

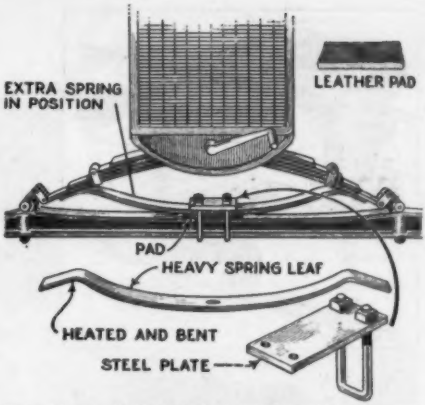
through a hole drilled in the frame, an eye in the end of the rod being slipped over the pivot pin. The rod is of such a length that it will project about 1/16 in. through the frame at 70° F. A small weight, about ¼ lb., is fitted with a wire hook and is suspended from the projecting end of the rod, and a length of cord connects the weight with the lever on the gas cock, which is fitted with an extension making it about 6 in. long. When the gas is lighted, the weight is hung on the end of the rod as indicated. As the aluminum strips get hot, they expand and pull the rod back, which in turn allows the weight to drop, closing the gas cock.—James Ellis, Memphis, Tenn.

Noisy Tin Can Frightens Birds Away from Fruit Trees

Wads of bright-colored paper and light bottles with small rocks in them are often tied to the branch ends of fruit trees to frighten away birds. Some birds are kept away, but it takes a good deal of continual noise to put sufficient fear into the hearts of the more courageous of the unbidden guests. To prevent the trouble, take an empty can, preferably an ordinary tobacco tin, and tear off the cover. Punch a small hole in the bottom for a string. Tie a fairly large nail or screw to one end of the string and make a large knot about 1 in. from the nail, to prevent it from being pulled against the bottom of the can, when hung in an inverted position, as shown in the drawing. The nail serves as a clapper, constantly jingling against the sides of the can, which is free to move in the wind. The least twist or jerk of the can will cause it to rattle and keep birds away.



¶An oil mop may be cleaned by dipping it in soap suds to which a little household ammonia has been added; rinsing in warm water completes the process.



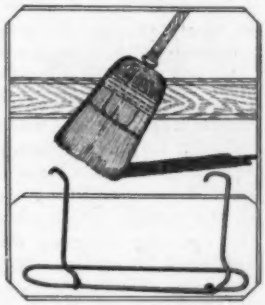
Extra Spring Leaf, Attached to Front Axle, Supports Front Spring in Light Car

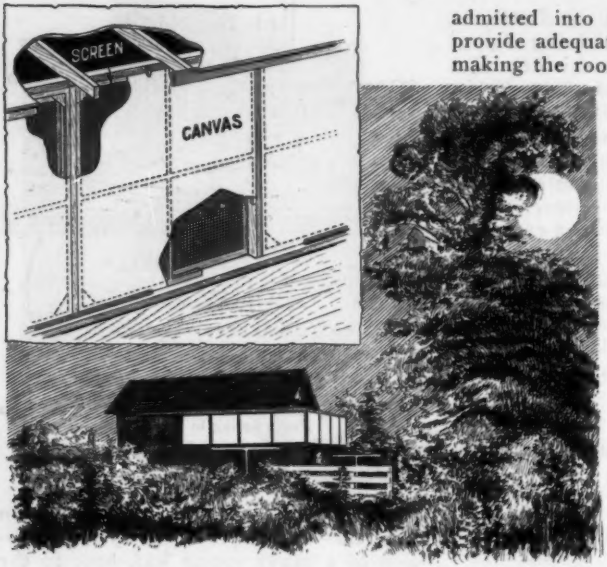
Preventing Front-Spring Breakage in Light Cars

Frequent breakage of front springs in light cars can be prevented by the provision of a heavy spring leaf, bent to the shape shown and attached to the front axle by means of two U-bolts and a tie plate. A leather pad, placed between the extra spring leaf and the axle, provides a certain amount of resiliency.—G. A. Luers, Washington, D. C.

Wire Holder Saves Broom

The life of a broom can be greatly increased by fitting it with the wire holder shown in the illustration, the function of the device being to prevent the long straws from spreading and breaking when the broom is used. The holder consists of a length of No. 14 wire, bent to form a loop which will fit snugly around the broom about 5 in. from the bottom. The ends of the wire are twisted around the loop and bent at right angles to form hooks, which are pressed into the top section to keep the holder in position securely.





Oiled-Canvas Screens Make This Cottage Porch a Comfortable Room Which Has Been Used All Winter

Additional Room for Cottage

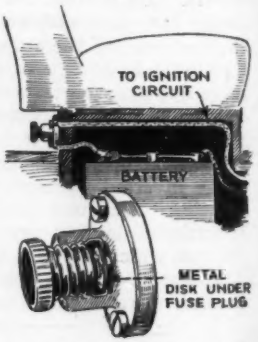
We needed an extra room in our cottage and built it in porch fashion, as shown in the drawing. The size was 10 by 20 ft. and the entire cost was about $100 exclusive of the work, which was done by an amateur. The sills were set on posts, the joists nailed on, and the floor laid over the joists in the usual way. Studs were then set up and the roof framing completed. The customary 1-in. stock was used to cover the rafters, and shingles were then applied. The studs are set 16 in. apart except where space was left for windows, which consist of canvas screens, oiled to resist the weather and to make them more translucent. The frames on which the canvas was stretched, were made of 1 by 2-in. stock, planed and painted. The canvas should be stretched over one side only and then tacked to the edges of the frame, which should fit snugly in the opening designed for it, small hooks and eyes being used to hold it in place securely. If desired, regular wire screens also may be provided so that, when the canvas frames are removed, the room is converted into an open porch. With the canvas screens in place, plenty of light is admitted into the room. Besides, they provide adequate protection against cold, making the room comfortable for general use. The porch, which the writer has built, has been used as a bedroom all winter, which has been the coldest winter in Oklahoma in thirty-five years. It is wind, rain and snowproof.—Mrs. V. S. Martin, Drumright, Okla.

Barbed Wire Cuts Haystack

Haystacks can be cut from top to bottom by means of a barbed wire. The wire is thrown over the stack and is pulled back and forth by horses hitched at either end until the stack is divided. This method works quickly and makes a clean cut. Two autos or trucks would be better than horses, although the latter have been used satisfactorily for the purpose by a farmer in the west.—L. C. Ferguson, Manteca, Calif.

Foiling Auto Thieves

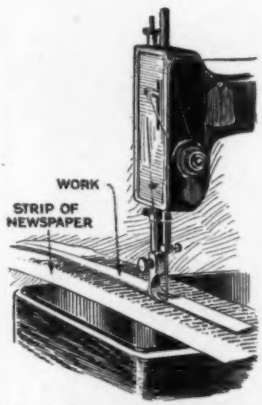
The auto ignition lock shown in the illustration embodies a simple method of making an auto thief pass up your car in preference to one that will start more easily. After he has shorted out the ignition switch he does not anticipate looking for another break in the wiring. An ordinary cleat socket is screwed in some inconspicuous position, as indicated, and is connected in the storage-battery circuit. Of course, the wires leading to the socket must be well concealed.



Chemical-Weighing Stunt for Amateur Photographers

Amateur photographers who do considerable dark-room work will appreciate this little stunt to save time and figuring when weighing out chemicals for making solutions. Drive several nails over the workbench in a line and label each one with the name of one of the chemicals used. Take several empty bags, such as tobacco sacks, and label each in the same way. Put enough shot in each bag to equal just the quantity of that particular chemical used in a standard formula. It is then a simple matter to use the proper bag of shot instead of the scale weights, and the various chemicals can be weighed out quickly and in exact proportions each time a batch of the solution is prepared.—L. B. Robbins, Harwich, Mass.

Sewing Narrow Tape



When you find it difficult to sew along the edge of a narrow length of doubled tape on your machine, try the kink shown in the drawing. The tape is laid on a piece of newspaper, and the two are sewed together as indicated, after which it is a simple matter to remove the paper. This method makes it comparatively easy to sew straight along the edge.—Albert E. Jones, Milford Station, N. S.

Rifle-Sight Kink for Hunters

When hunting deer, many running shots are missed because it takes too long to get the bead of the front sight in the notch of the rear sight and on the mark. I have eliminated this difficulty in a very simple way. The front sight is removed, and a copper rivet is cut to the same height and fitted into the sight slot. A groove

Silver-Wound Guitar String Makes Quick Sighting Arrangement on Rifle

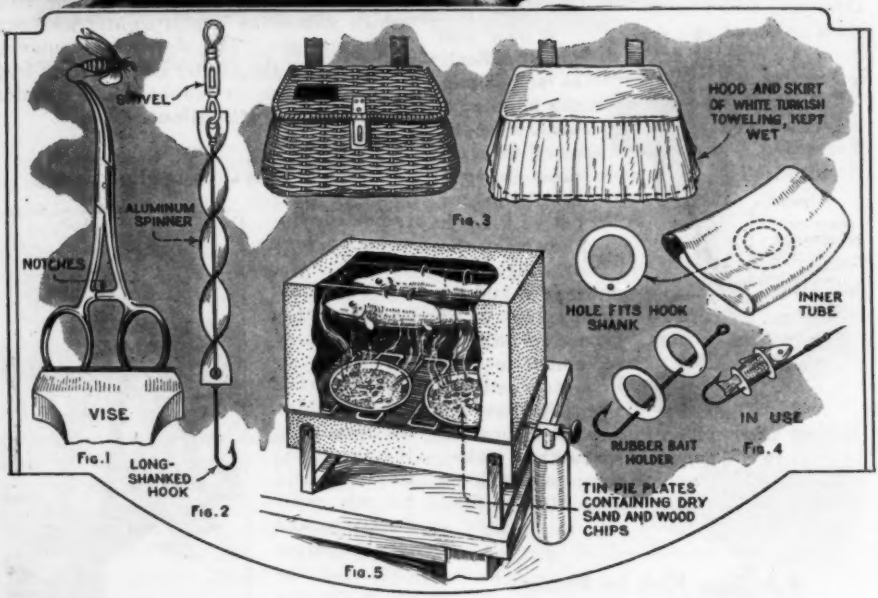
is filed in the top of the rivet to hold a silver-wound guitar or cello string. One end of the string is fastened around the muzzle of the gun, in front of the rivet, the string is then laid in the notch in the rear sight and the other end is tied to the gun as shown. When tying the string, get it as taut as possible, and then force the front end of the string up on the rivet which will make it still tighter and perfectly straight. This sight can be quickly seen, so that the hunter can instantly level it on the mark and shoot.—J. J. Brindos, International Falls, Minn.

Ladder Stile Crosses High Fences

For the unusually high fence, the method of passing from one side to the other by means of a special ladder, as shown in the photo, has been found entirely satisfactory and much cheaper than the installation of a gate. It is a double ladder with the feet well imbedded in the ground and the top securely joined by means of cleats and a single wide board. Each step is a 20-in. length of 1 by 4-in. board, set between 2 by 4-in. uprights.—Dale R. Van Horn, Lincoln, Nebr.

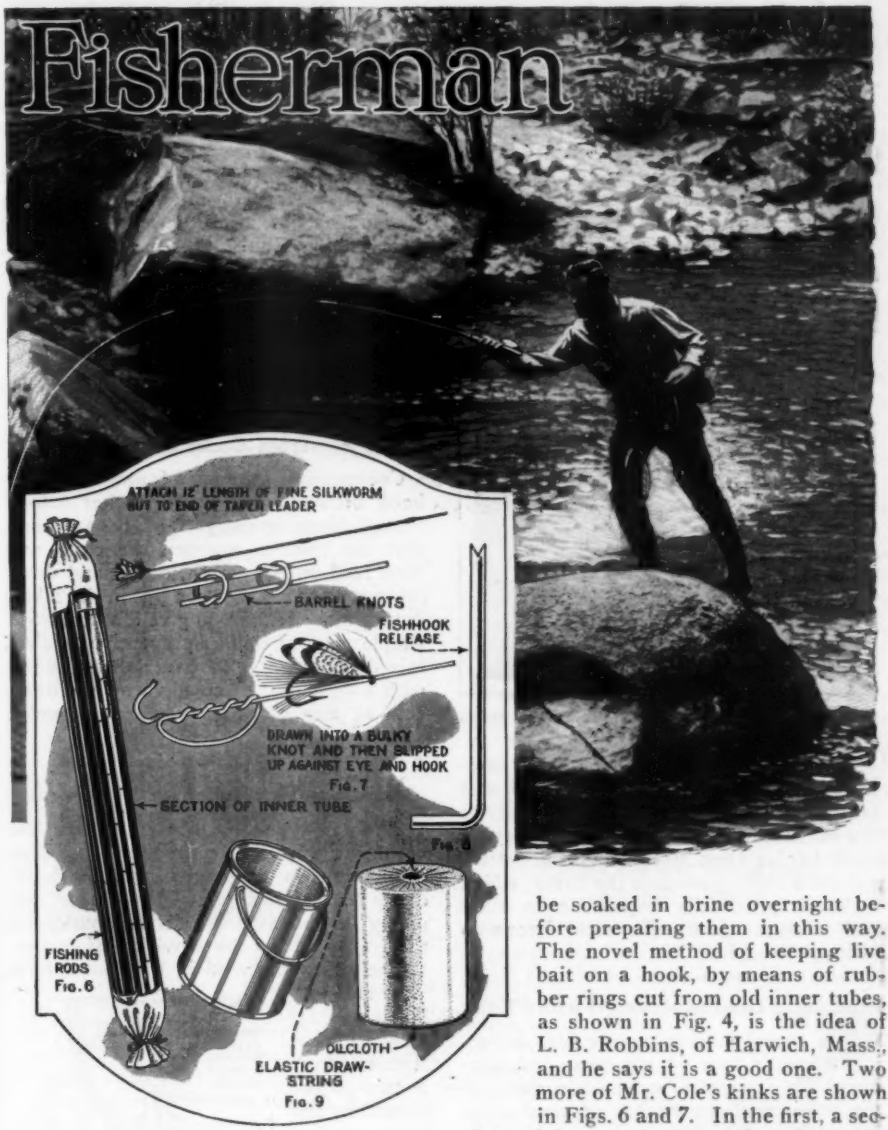
Tips from the Expert

which the fly can be worked on with ease, as both hands are left free and there is nothing in the way of the thread. For bay bluefish, live killies and spearing are used as bait, but when it is difficult or impossible to get these, John D. Mayer uses a lure made by twisting a ½ by 4-in. strip of aluminum, as shown in Fig. 2. It should, of course, be swiveled as indicated. It is a good idea to keep your creel as cool



THOSE who have found the ordinary fly-tying device for holding hooks unsatisfactory, will take the tip of Robert Page Lincoln and use a surgeon's haemostat, an instrument shaped somewhat like scissors and having a flat tip. The fishhook is held firmly by the clamping action of the notches indicated in Fig. 1, after as possible, to prevent spoiling the fish. Dick Cole has found this can be done by painting the outside with aluminum paint to reflect sunlight, or by providing a cover of white Turkish toweling, as shown in Fig. 3, which, when wet, keeps the creel cool by evaporation. Mr. Cole has also found that tasty smoked fish can be pre-

Fisherman



pared in a camp stove by placing tins (not aluminum plates) of sand and wood chips over the burners and suspending the fish in the upper part of the oven as shown in Fig. 5. When the wood starts to smolder, turn the flame very low, just sufficient to keep the wood smoking. The fish should be soaked in brine overnight before preparing them in this way. The novel method of keeping live bait on a hook, by means of rubber rings cut from old inner tubes, as shown in Fig. 4, is the idea of L. B. Robbins, of Harwich, Mass., and he says it is a good one. Two more of Mr. Cole's kinks are shown in Figs. 6 and 7. In the first, a section of inner tube is used to keep the rods in good condition when stored during the winter, saving them from rapid deterioration in the dry atmosphere of the modern home. To tie dry-fly hooks, he uses a 12-in. length of silkworm gut, soaked in water and attached to the end of the regular leader with a barrel knot.

The hook is slipped on the end as shown; then the end of the gut is tied into a bulky knot, which prevents the hook from coming off. According to Mr. James E. Noble, Toronto, Can., a short piece of heavy galvanized-iron wire, bent to the shape shown in Fig. 8, and filed to a vee in one end, will be useful for releasing hooks from the throat of fish without risk of pricking one's fingers. Hi Sibley has found, on his fishing and camping trips, that inclosing soot-covered camping utensils in suitable oilcloth bags fitted with elastic drawstrings, as shown in Fig. 9, simplifies his packing troubles.

Protecting Typewritten Checks

Blotter Inserted under Check in Typewriter Makes Erasing Impossible

Typewritten checks can be easily protected by placing a small sheet of soft blotting paper underneath the check, as shown in the photo. Strike the keys a little harder than usual, and the letters will then partly perforate the check, which makes it practically impossible to erase and change them.—Kenneth Bronaldo Murray, Sturgis, Mich.

Road Signs Used as Moving-Picture Titles

In a recent motion-picture film depicting a motor tour of the west and produced by a western automobile club, all the titles used are flashes of road signs set up for the information of tourists. This method of producing titles has a strong appeal to users of small motion-picture cameras who record their motor vacations. Besides providing the information desired, such signs give a touch of local color. They naturally appear just where needed on the picture.

Obtaining Chimney Draft

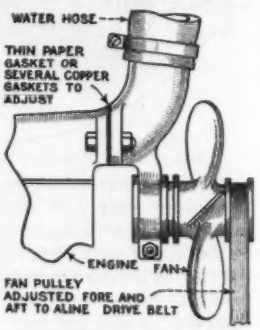
I owned a house standing beside a high railway embankment, and was troubled occasionally with drafts that prevented the proper operation of the chimney. After trying various methods of eliminating the trouble without any noticeable effect, I followed the suggestion of a man passing by one afternoon, who said that he could cure the trouble for half a dollar. His remedy consisted in taking a brick out of each flue, near the top of the chimney, on the side away from the embankment. No more trouble was experienced. —R. P. Harrison, Vancouver, Can.

Save Your Book Bindings from Cockroaches

Cockroaches have been found to destroy book bindings and other leather substitutes. Upon investigation, it was found that the roaches moisten the cloth and then feed on the starch, casein and other substances that have been put in the fabric during manufacture, to give it stiffness. A simple and effective preventive against this destruction is to cover the bindings with a light coat of copal varnish, obtainable at any paint store.—Thos. Goudie, Bombay, India.

Adjusting Fan Pulley on New Fords

The new-type Ford fan pulley, with its mounting integral with the water-pipe connection on the engine cylinder head, easily can be adjusted to place the pulley in line with the driving pulley on the crankshaft by the provision of gaskets at the point indicated in the illustration. When the pulley is too far forward, substitute a heavy brown-paper gasket for the copper gasket, and when the pulley is too far to the rear, use two, three or even four of the usual gaskets to


WATER HOSE
THIN PAPER GASKET OR SEVERAL COPPER GASKETS TO ADJUST
ENGINE
FAN
FAN PULLEY ADJUSTED FORE AND AFT TO ALINE DRIVE BELT

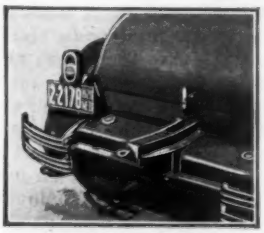
bring it forward and into alinement with the drive pulley.—G. A. Luers, Washington, D. C.

Exterminating Rats

While in charge of a chain store, containing three large storage rooms in the rear, I was troubled for a remedy to check wharf rats from eating up my profits. I obtained an old rag mat, saturated it with water and placed it in front of the rat hole. In front of the mat, I placed a sheet of wrapping paper on which I sprinkled some lye. The rats coming out of the hole ran over the wet mat and then over the lye. The moistened lye adhering to their feet caused so much irritation that it did not take very long before they all disappeared.—Peter Dyer, Charlestown, Mass.

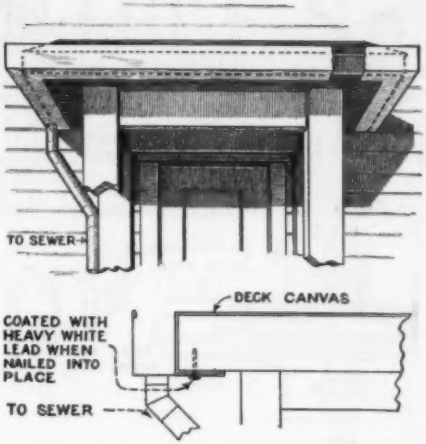
Neat Towing Device for New Cars

An unusually neat towing device for new cars is shown in the photo. It consists of two lengths of heavy angle iron and a piece of strap iron, fastened together and attached with bolts and rivets to the apron over the gas tank. A short piece of heavy metal is brazed to the rear ends of the two lengths of angle iron, to form a seat for a coil spring. It is drilled for a ½-in. rod, which is attached to the spring by means of a nut, and a large washer is placed on the front end of the coil spring. The rear end of the rod has been shaped to form an eyelet for the towing hook. The device has been used by a salesman who employs a trailer for transporting his wares.—Dale R. Van Horn, Lincoln, Nebr.



Small Gutters for Door Canopies

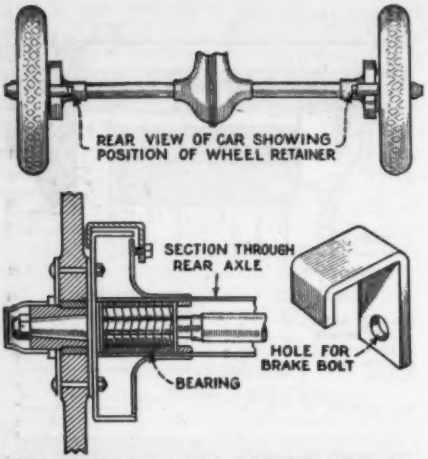
Very often small canopies over doorways are not provided with eave troughs. A regular-size trough would be out of proportion, so it is advisable to provide a smaller one. Simply take strips of galvanized sheet iron of the desired width and bend them lengthwise at right angles. By tacking these to the underside of the roof at the edge, a satisfactory gutter is formed, as shown in the illustration. If possible, the entire trough, comprising three separate sections, should be built up to form one unit, the individual parts being securely soldered together. To prevent water from seeping between the gutter and the roof, a good coat of white lead should be applied. A downspout should also be installed.—L. H. Georger, Buffalo, N. Y.



This Small Homemade Gutter Will Be Found Better Than a Large One on a Door Canopy

Carpet Cleaner Made from Flexible Tubing

An effective carpet beater can be made from flexible metal tubing, or conduit, such as used by electricians, as shown in the illustration. In cleaning a number of heavy canvas pieces, this device was found much more satisfactory than an ordinary carpet beater, as the latter was too light and frail for the purpose. Wrap and tie the ends of the tubing together with a length of stout cord or adhesive tape to form a handle, and the beater is ready.



Simple U-Shaped Device Keeps Rear Auto Wheels in Place When Axle Is Broken

Retainer for Rear Wheel When Axle Breaks

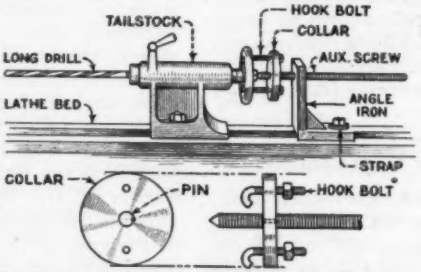
The wheel retainer shown in the drawing is U-shaped and is made from a piece of 7/16-in. steel, a hole being drilled in one leg to accommodate the brake-centering bolt, while the other leg forms a retaining lip to go around the brake drum. The retainer is an emergency device which keeps the wheels from running off when the axle is broken inside of the wheel bearing. When used, the brakes can be applied, and the wheel will be securely held in place while the car is towed.—G. A. Luers, Washington, D. C.

A Kink for Fly Fishermen

Dry-fly fishing is rapidly gaining favor with trout fishermen. To obtain best results at this art, the line, leaders and fly must be treated with something to make them impervious to water. Many special preparations are on the market for this purpose, the greasy kind being equal to, if not better than, many others. It can be purchased in tubes, is easily applied and will not leave an oily film on the water as mineral oil does. A small quantity on the wings of a fly will make them retain their shape and will also increase the buoyancy.—Dick Cole, Los Angeles, California.

Increasing the Tailstock Feed

Because the tailstock of an engine lathe is not ordinarily intended to be used for drilling holes, the travel of the spindle is somewhat limited. This is especially true when using long drills for deep holes. In such cases the drill is advanced as far as the spindle will permit; then it is withdrawn and the tailstock is pushed up and the drilling resumed. This is an awkward job, especially if many pieces are to be handled. The writer devised an arrangement that overcomes the trouble by making it possible to feed a drill or reamer straight through a deep hole, even though it is twice as deep as the travel of the tailstock spindle. To make such a fixture, get an old 1-in. screw having eight threads per inch. Saw off the head and point the end to fit in the center of the tailstock screw at the back. Next make a collar to fit the screw, pin it in place and tap it in two places for a couple of hook bolts, made by bending over the ends of two studs. Last, tap an angle iron to take the screw, and the device is ready for use. The angle iron is strapped to the lathe bed and the auxiliary screw is attached to the tailstock by means of the hook bolts, over the arms of the tailstock handwheel. In use, the tailstock nut is loosened just enough to allow it to move easily along the lathe bed. It will be seen that one revolution of the handwheel moves the spindle the distance of one thread in the tailstock and also the tailstock itself the distance of one thread in the auxiliary screw. In this manner, a long feed and a quick return of the drill, if it is necessary to clear out the chips, are simply obtained.—Harry Moore, Hamilton, Canada.



Arrangement on Lathe by Means of Which Reamer or Drill Can Be Fed through a Deep Hole

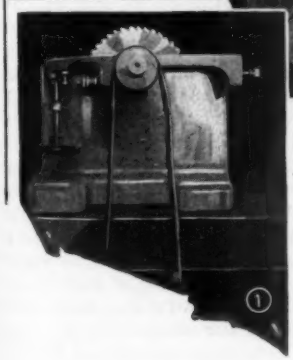
All Shop Notes published in 1928, in book form—Fifty Cents—from our Book Department

Getting the Most Out of the Bench Saw

By W. CLYDE LAMMEY

MANY owners of small belt-driven bench-saw rigs have trouble getting reasonably good service from their outfits, and it generally appears difficult to discover a remedy. Nevertheless, when it requires coaxing to get the saw through ordinary work; when, in ripping, it is necessary to stop feeding and wait for the blade to catch up speed, and, lastly, when practical work with the dado head is almost out of the question, we may be sure that something is wrong.

Rigs, driven by separate motors using a flat belt to transmit the power, are most likely to give trouble, unless we resort to a very stiff tension, which is detrimental. The belts used on most small rigs require too heavy a tension for maximum life of bearings, as the journals of the smaller motors are not designed to carry the weight of a very tight belt in addition to the load. In short, we may, in the majority of instances, look to the condition of the belt



and the size of the mandrel or spindle pulley and there find out what is wrong.

In the first place, the belt is required to turn a very small radius at high speed, and on the average small saw spindle, the pulley is made of iron, machined smooth, which last materially hinders the gripping power of the belt. In addition, the belt generally used or furnished is of standard single-ply leather. With a pulley radius under 1¼ in., the single ply is far too heavy for service on a bench-saw spindle, especially where the belt is short.

Fig. 1 shows a standard-thickness single-ply leather belt under light tension, no more than should be necessary for ordinary work. A glance will show that this belt is in no fit condition to run on a pulley of the small radius shown, no matter what the tension allowable. As the first step, it is better, though not absolutely essential, to replace the iron spindle pulley with one of paper, having the latter as large in diameter as the space between the spindle and table will permit, and increasing the diameter of the driver to get the required speed. With a 6-in. saw, this should never be less than 3,500 r.p.m. However, in this it must be remembered that it is also possible to run the saw blade too fast and thus lessen its capacity greatly. The 6-in. blades of the better makes are designed for approximately this speed, and any material excess causes the teeth to drag in the cut. This must be remembered when altering the pulleys. With a motor running at a load speed of 1,750 r.p.m., a driver 4 in. in diameter and a spindle pulley 2 in. in diameter (provided the space permits) will give the correct speed when the belt is in condition.

Where a 6 or 7-in. saw is used, the belt should never be less than 1½ in. in width and, if we are to replace the original spindle pulley, the new one should be as wide as the available space permits. Wherever possible, it is better to procure a pulley 2 in. wide for a 1½-in. belt, and, if the original is between bearings, as in Fig. 2, and the space does not allow, put the new paper pulley onto the outer end of the spindle.

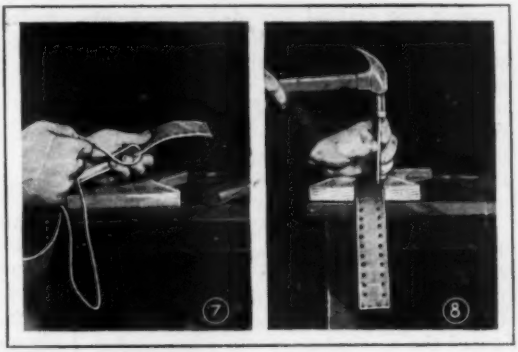
But despite the advisability of replacing the spindle pulley, the belt is, after all, the chief consideration. We will get along very well with the iron pulley if the belt is put in condition. Standard leather belting is from ⅛ to 3/16 in. thickness, often more, and for the small-spindle pulley it is best reduced to a uniform thickness, very slightly below ⅛ in. To do this, sharpen the iron of the block plane to a razor edge and set it to take a very light cut. Lay the belt, flesh side up, on a flat, true surface and plane off the waste (Fig. 3), being very careful to come to uniform thickness, just slightly below ⅛ in. If the belt is endless, lay it over a corner of the bench

when planing. A certain portion of the stiffness is thus taken out of the belt, and by planing down, we materially reduce the friction of the fibers caused by bending over the small pulley. A belt that has been run for some time need not be planed quite so thin.

Next, lay the belt on a flat surface and loop it, as shown in Fig. 4, having the flesh side out, and using a fairly heavy pressure, roll the loop back and forth, continuing the operation from one end to the other several times. The endless belt is, of course, worked back and forth from the starting point. Continue the rolling until the loop can be pressed tightly together with two fingers. This operation takes the stiffness out of the leather most effectively, and will render the belt as pliable as though it had been soaked in harness oil over a long period. Fig. 5 shows the same belt as Fig. 1, after the planing and rolling operations. In each instance, the belt is under exactly the same tension. It will be seen from Fig. 5 that the stiffness is taken out of the leather, allowing the belt to grip the pulley most effectively.

The virtue of holes punched along the edges of a belt is sometimes questioned, and, while they are of little use on a belt run over a pulley of 4-in. diameter or more, it has been the writer's experience that, along the edges of a belt that must turn a small radius, the holes are of some value. In the first place, they facilitate the escape of the entrapped air, and it is certain that they materially lessen the tendency of the belt to "flap" or vibrate excessively. Further, the holes tend to equalize the stretch, especially in a new belt, and add materially to the ease with which the belt will bend around the small pulleys. It is important that the holes be equally spaced. Fig. 6 shows a line being struck along the edge of the belt as a guide for punching the holes. Lay a rule along this line and mark the ¾-in. spaces. Make the holes with a 3/16-in. punch, as shown in Fig. 8, setting the punch on the intersection of the lines previously made along the edge.

If the belt is not endless, it will be necessary to lace it very carefully to insure smooth running. When measuring for final length, have motor and saw in the closest position so as to obtain the greatest possible adjustment to take up the slack and stretch. Mark for cutting about ⅛ in. shorter than the actual measurement. Lay the belt on a flat surface, and, using the try-square, cut the ends exactly square. This last cannot be overemphasized, as the belt will travel at high speed and a slight unevenness at the joint will cause it to vibrate sideways, and, in addition, the belt is likely to be thrown from the pulleys when put under load.



If the belt is 1½ in. wide, at least four holes should be punched for the lacing in each end and they must be carefully located so that, when laced, the edges of the joint will be even and the holes exactly opposite each other. Use a scratch awl instead of the ordinary leather punch, as this severs the fibers of the leather, which is likely to allow one side or the other of the joint to stretch slightly and throw the belt out of line. Punch the holes only just large enough to allow a large sewing needle to pull through easily. The holes should be about 3/16 in. back from the end; a greater distance is likely to result in a bulky joint, which is almost certain to cause trouble on the small pulley.

Rawhide is not suitable for lacing a belt that has been worked down to the thickness we now have it. Shoemakers' linen thread, heavily waxed and looped to make four strands, makes a clean, smooth joint and will last nearly as long as rawhide. Thread two strands through a heavy sewing needle and tie the four strands together. Fig 7 shows the manner of starting the lacing by running the needle through the outside hole and then

through the divided strands. Pull tight and run the needle through the opposite hole in the other end of the belt and then back through the first. Cross over to the next hole, bringing the thread across the joint, down through and back to the opposite hole. One thing we must be sure of: The stitches must cross only on the outside (flesh side) of the belt.

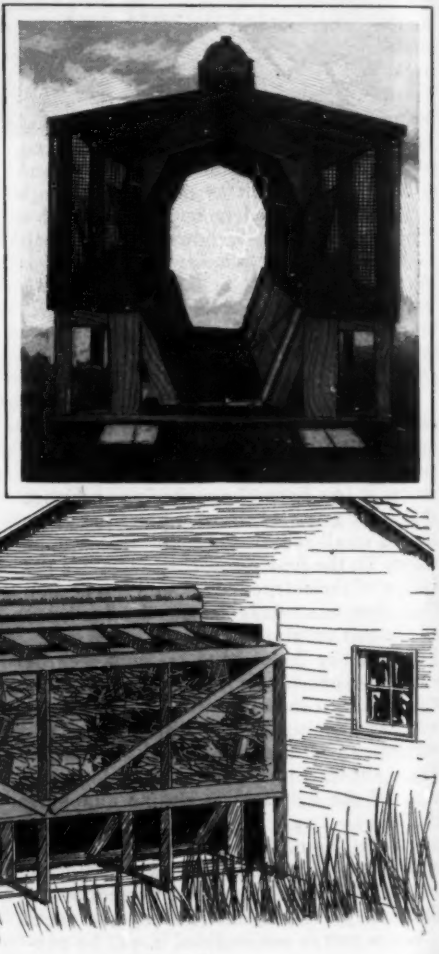
Standard leather belting is stamped at intervals with an arrow, indicating the direction in which the belt should be run, and it is important that this be carefully observed. Running the belt in the direction of the arrow brings the grain of the leather in contact with the pulley surface at an angle which gives the belt its greatest gripping power. Axiomatic also is the rule that the belt should always be run with the hair side next the pulleys.

Never soak the belting in oil to soften it or apply heavy oil or grease to the surface while it is in use. A good leather belt will remain in the very best condition without oil if kept in a dry place.

When finished and laced, put the belt on the pulleys and tighten it only just enough to take up all the slack; no more should be necessary, and it should require a good stout pull by hand to slip the belt on the spindle pulley when under this tension. Start the motor and apply a very little friction belt dressing to the hair side. Now, if we have our saw driven by a ⅓-hp. motor of the better make and the belt under the tension like that mentioned above, we should be able to finish a ripping cut through a 4-ft. length of ordinary pine stock at the count of fifteen, perhaps less with a newly sharpened and well-jointed saw blade.

Trap Keeps Cows Free from Flies

Dairymen at the Central Oklahoma State hospital have devised a trap which has proved successful in making the large cow barn flyless. The trap is about 7 ft.



Dairymen Will Appreciate This Trap, Which, Although Rather Large in Size, Has Been Found Very Effective in Freeing Cows of Flies as They Are Entering the Barn

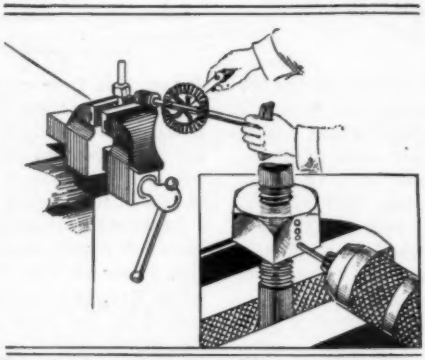
high, 12 ft. long and wide enough for a cow to pass through, the exact shape and construction being clearly indicated in the photo and drawing. The principle involved is that flies, when disturbed, fly upward. To dislodge them from their position on the cow's back, broom corn is placed inside the trap, so that it projects toward the inside, brushing against the cow when she passes through the trap. The flies swarm toward the top where they pass through a narrow passage into a screen cylinder, from which they cannot readily escape. The cylinder is removable so that the flies can be disposed of by drowning, burning or otherwise. The trap is set in front of the barn door, making it necessary for every cow to pass through it when entering.—Robert V Peterson, Stillwater, Okla.

Rapid Method of Filtering

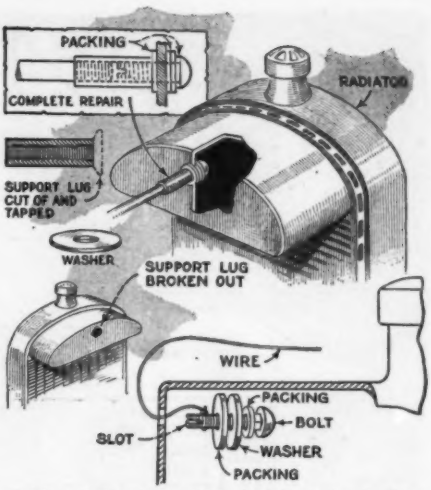
Filtering can be speeded up considerably if a piece of wire screen is cut and formed into a cone that will fit into the funnel. Put the screen cone into the funnel and then place the filter paper on the inner surface of the screen. This will allow the liquid to flow from the entire surface of the paper.

How to Remove a Frozen Nut

When it is necessary to remove a frozen nut from a stud on a piece of machinery, and it is not advisable to take out the stud, try the method indicated in the drawing. Drill a row of small holes through the side of the nut as shown. If a wrench is applied, the sections between the holes will usually stretch sufficiently to loosen the nut. If, however, the nut is thoroughly rusted all around, drive a cold chisel through the row of holes to spread the nut apart. It may even be necessary to drill a row of holes on each side so that the nut can be broken in two.



Easy Method of Removing a Frozen Nut from Piece of Machinery

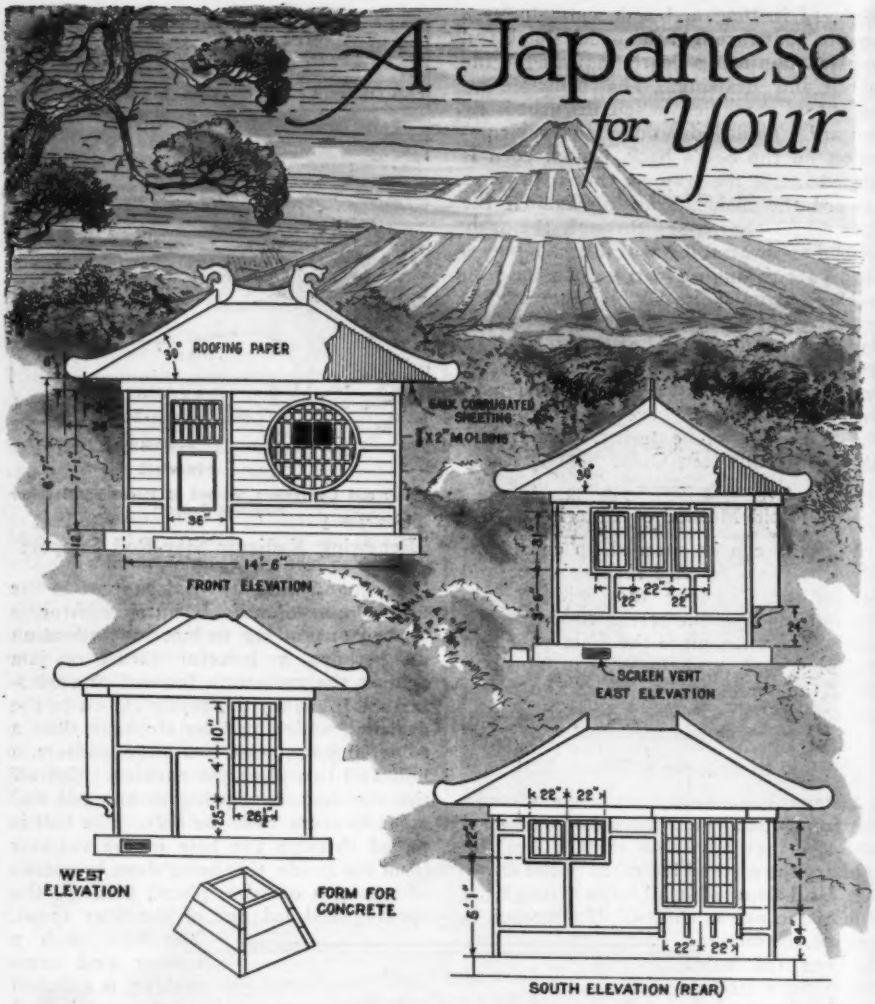


Quick and Convenient Method of Renewing Radiator Stay-Rod Support

Renewing Radiator Stay-Rod Support

Frequently the stay-rod support in the upper reservoir of an auto radiator is broken out, owing to incessant vibration or, perhaps, a forceful thrust or jam against the radiator. Instead of soldering the joint, try the repair shown in the drawing, which will be stronger than a soldered joint. Get two large washers, a bolt and two pieces of packing. Cut off the stay-rod support lug at one end and tap it to screw over the bolt. The bolt is pulled through the hole in the radiator from the inside, this being done by means of a length of wire, placed through the opening and led out of the filler spout. The bolt, with a washer and some packing, is attached to the wire and pulled through the hole. A screwdriver slot, sawed in the end of the bolt, is the means of holding it from turning while the support lug is screwed in place. This repair can be made without removing the radiator, saving time.

A Japanese for Your

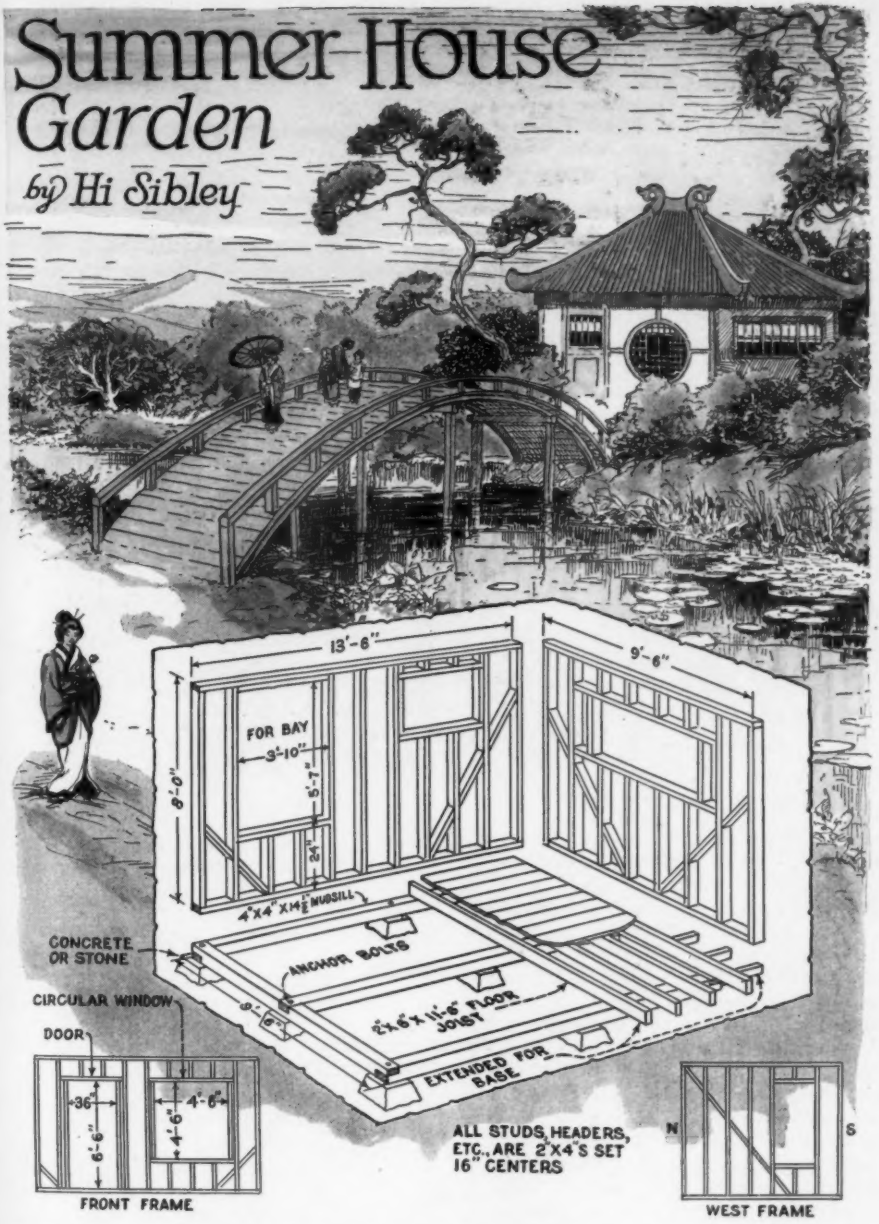


SET in a cluster of shrubbery at the far end of your garden, this little Japanese tea house will add a picturesque touch not achieved in any other style of architecture. It lends itself particularly to the development of the popular rock garden, and if one cares to elaborate on the idea, a lily pool with high-arched footbridge, a stone lantern and a few dwarf evergreens fit into the scheme admirably.

A few modifications from the true Japanese have been embodied to simplify construction for the home craftsman. In Japan, this type of structure would have a tile or thatched roof; here we recommend galvanized, corrugated sheet iron for economy and easy installation. Paper windows, or "shoji" are the rule in the "Land of the Cherry Blossom," but unless a Japanese craftsman can be found who knows the approved method of applying rice paper so that it will be drum-tight when dry, it is advisable to use muslin tacked to the window frames. Also, in the Orient sliding windows are in universal use, but for simplicity and convenience

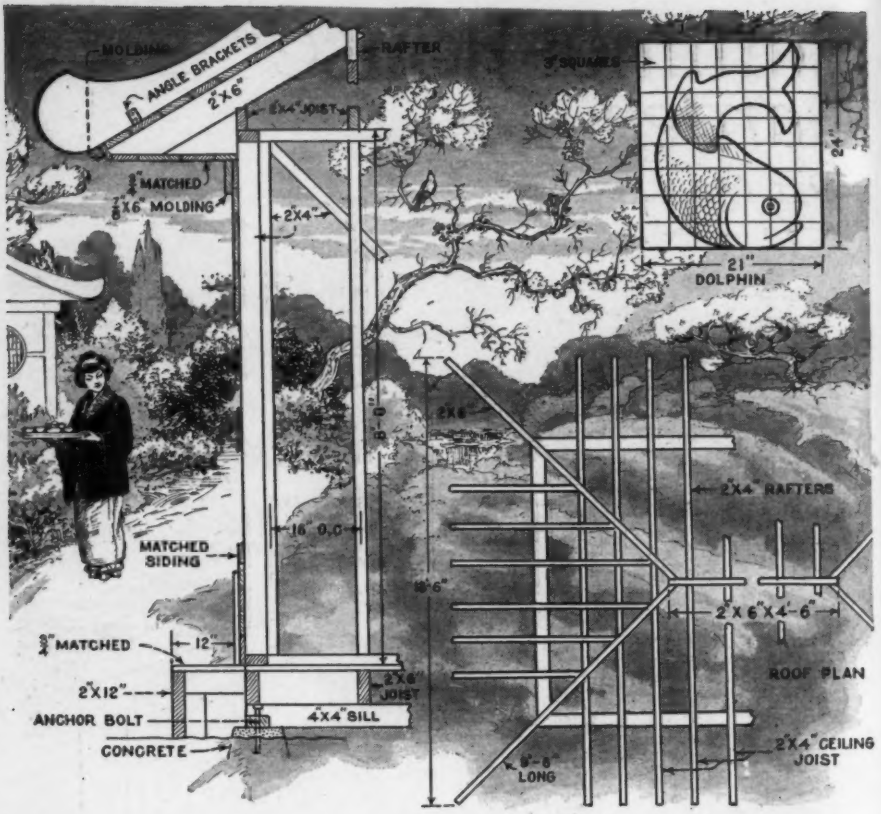
Summer-House Garden

by Hi Sibley



in this design, we have made all casement windows, except the large circular window in the front wall.

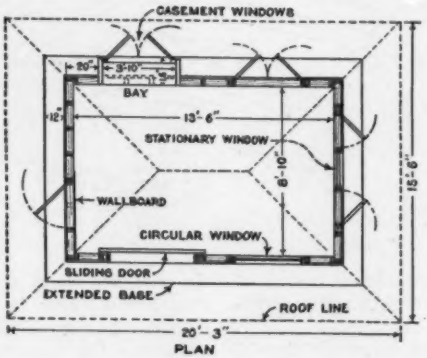
One attractive feature, however, should be retained—and that is the unpainted, weathered outside walls. Houses in Japan, when made of wood, are left to the elements for outside finish and in time



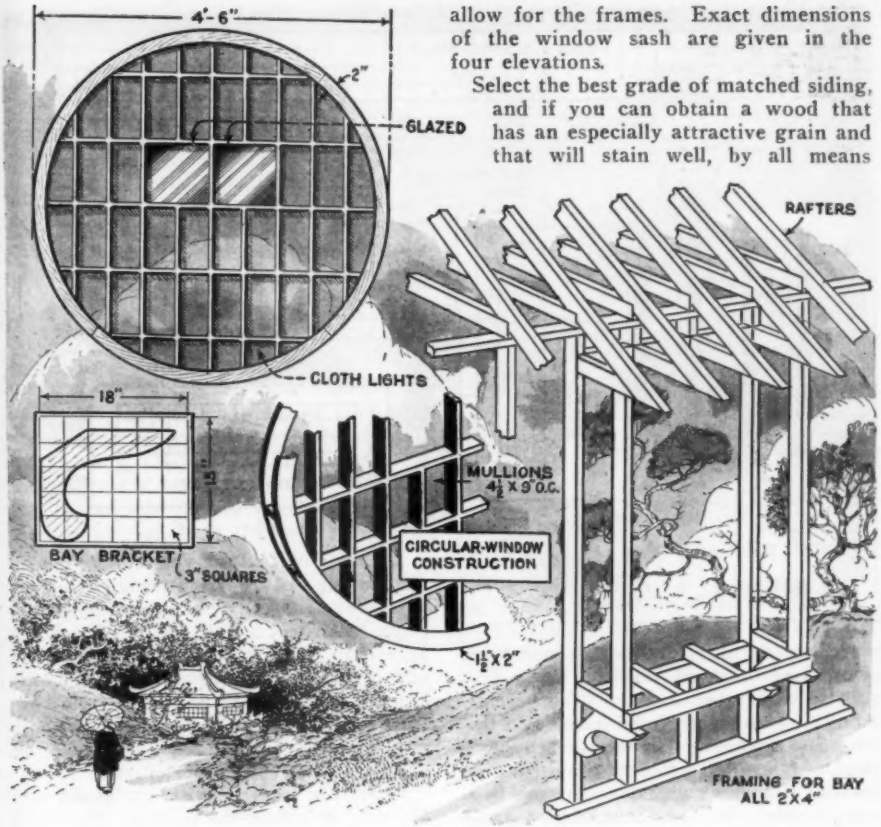
assume a quaint mellow-gray effect. To simulate this, the new boards can be treated with a driftwood stain, or some other application suggested by the painter.

Practically all of this structure, excepting the window sash, can be built by anyone of ordinary skill with tools. However, a summer house of this character is worthy of the very best workmanship, and it may prove advisable to employ an experienced carpenter for the job. Doubtless he will be able to suggest short-cuts and certain changes to suit an individual location that will substantially improve the completed structure.

Note that the base extends 1 ft. on all sides. This is primarily for appearance, and at the same time serves as a sort of miniature terrace for potted shrubs of the Japanese variety. The floor joists are extended 1 ft. on the front and rear sides to carry this terrace, and on the ends short pieces of 2 by 4-in. stuff are used for the same purpose.



In sections where strong winds are frequent, it will be



allow for the frames. Exact dimensions of the window sash are given in the four elevations.

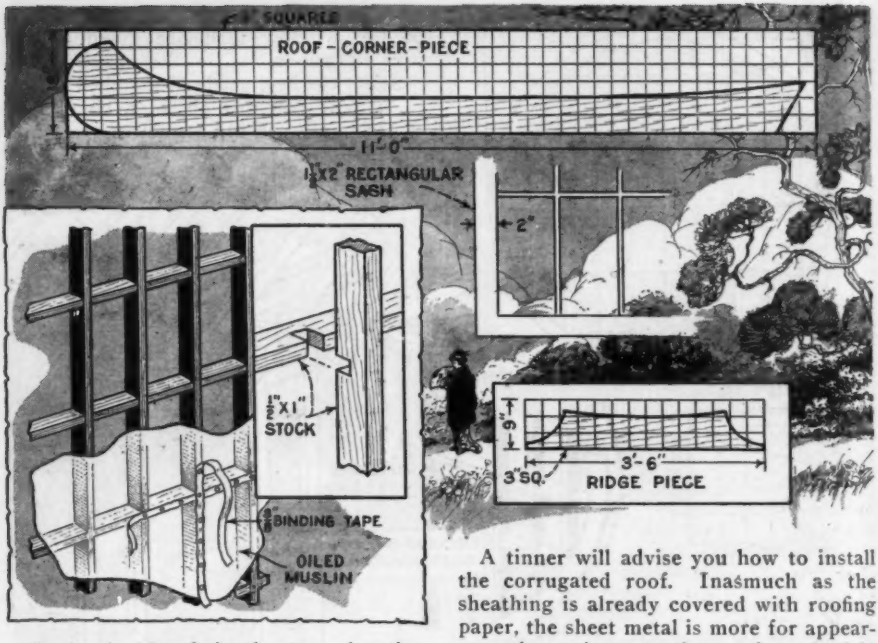
Select the best grade of matched siding, and if you can obtain a wood that has an especially attractive grain and that will stain well, by all means well to anchor the mudsills to concrete piers in the manner shown. If you do not wish to bother with making concrete, at least use large stones at the corners and under the central parts of the sills, as wood supports will rot in time and allow the house to sag in spots.

Construction proceeds in the following order: concrete piers or foundation, mudsills, floor joists, floor, side frames, ceiling joists, roof frame and rafters. Braces at the corners of the sidewall frames are installed after the frames are set up and squared.

Lay the roof sheathing and roofing paper before going ahead with the rest of the work, so you will have a dry place to work in if stormy weather occurs.

In making openings in the side frames for windows and door, do not forget to do so. The beauty of the exterior is greatly enhanced by an attractive grain. A darker stain on the exterior molding will set off the plain panels.

The window sash are really a job for the sash-and-door mill. However, to achieve the true Japanese effect, the mullions should be of rectangular section, and the lights, or individual frames, 4½ by 9-in. on centers. Note that there are two glazed frames in the circular window. This follows the Japanese practice of having at least some point of transparency in the translucent paper windows. In case you use muslin or any other cloth you think better suited for the purpose of windows, tack it on the inside of the mullions, using ⅜-in. black binding tape. A wood molding holds the cloth in place around the edges of the sash.



A pleasing break in the rear elevation is attained with the shallow bay. This adds considerable extra work, yet, although by no means indispensable to this design, contributes much to appearance, and justifies the effort required. The detailed drawing suggests one method of constructing this, but the builder may use any plan. In ordering your sliding door, be sure to specify a curly-maple panel, or some other wood with a bizarre grain, like slash-grain fir, for by contrast with the plain sidewalls it will heighten the pleasing effect of both.

The roof decorations are important. It may be necessary to build up the long corner pieces from two boards, as they are 15 in. wide at the curved end. These should be well sanded, for they are to take two or three coats of gold or bronze paint, as are the dolphins and ridge piece. In finished size, they should be 1 in. thick. This is a job for a bandsaw, or a good husky jigsaw. Laying them out is a simple matter by using the squared diagrams. They are attached to the roof with metal brackets, which can be purchased at a hardware store and bent to the angle required.

A tinner will advise you how to install the corrugated roof. Inasmuch as the sheathing is already covered with roofing paper, the sheet metal is more for appearance than rain protection, and can be laid accordingly. Chinese red on the corrugated roofing will stand out in vivid contrast to the adjacent foliage, but for those who do not care for such brilliance, an oriental green will be preferable.

Panel the interior with wallboard and battens, including the ceiling. Provision should be made for electric lights or Japanese lanterns, and in case you expect to spend summer evenings here, you will need to arrange for screens. These necessarily will be on the inside and of the type used in connection with casement windows.

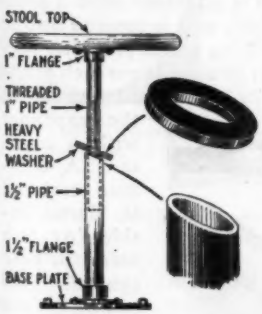
To adhere to the Japanese idea, straw matting should be laid on the floor. It is not likely that the true Japanese "tatami" (floor matting) is available in this country, which is unfortunate, as it is of beautiful, smooth-surface texture, over 1 in. thick and made up in sections about 3 by 6 ft. In fact, all interiors over there are designed for a certain number of tatami and dimensions of rooms are given as four, or six tatami, or whatever the number may be.

Reed furniture will be in keeping with your little tea house, and a Japanese screen

adds to the oriental atmosphere. Hang a Japanese scroll on the wall at the side of the bay, an old Japanese print or two, and a potted dwarf plum tree on a low stand in one corner, and you can fancy yourself in Old Japan—with modifications. Scaled down in size, this design will make an attractive and unusual playhouse for the children, if space does not permit the erection of the larger structure, and scaled down still more, it will make a dollhouse that will delight the heart of any child.

Quickly Adjustable Shop Stool

Built almost entirely of pipe and pipe fittings, and having the advantage of being quickly adjustable, the stool shown in the illustration will be found convenient in the shop. Bolt a 1-in. pipe flange to the underside of an ordinary stool seat and thread into it a 20-in. length of 1-in. pipe, which has been threaded nearly its entire length. A heavy steel washer is then cut out to fit loosely over this pipe, and to grip it when inclined at about the angle indicated. Slip the washer over the pipe. The base consists of a 20-in. length of 1½-in. pipe, threaded into a 1½-in. floor flange, which is in turn fastened to the floor or to a large metal disk, as shown. The top of the 1½-in. pipe is sawed off at the angle indicated, which is slightly greater than the angle at which the washer grips the pipe on the seat. To raise or lower the stool, simply hold the washer horizontally and slip the smaller pipe through it. When the seat is released, the washer will drop into place over the base pipe and will grip the threads in the smaller pipe. The greater the pressure on the seat the more secure will be the grip of the washer.



¶Before painting window frames, smear some soap on the glass near the edge; this will protect the glass from splatters.

Using a Slotted Nut and a Wooden Lever to Compress Auto-Valve Springs

Slotted Nut Aids Valve-Spring Assembly

For removing or replacing the valves in an overhead-valve auto motor, the simple tool shown in the drawing will be found very handy, and any motorist can make it in a few minutes. It consists of a large nut, slotted at one side so that it forms a U-shaped spanner. By placing this over the valve stem, with the legs set firmly against the spring-retaining washer, and applying pressure by means of a wooden lever, as indicated, the spring can be compressed to permit removing or inserting the pin.—G. A. Luers, Washington, D. C.

Rust-Proofing Iron and Steel

The metal to be treated is first immersed briefly in a boiling solution of sodium or potassium hydrate to remove oil and grease. If rusty or badly tarnished, it is given the ordinary sulphuric-acid pickle. It is then well washed in clean water, preparatory to the final treatment. The rust-proofing fluid consists of a 4-per-cent solution of phosphoric acid mixed with clean iron filings. It is kept at boiling temperature. The article is immersed in the boiling solution for 2½ to 3 hours. The metal will then have a greenish-black appearance. Dry and oil it with linseed or paraffin oil. The final color will be a grayish black.

Homemade Elevator for Stacking Grain Bundles Which Is Driven by a Tractor

Stacking Bundles by Engine Power

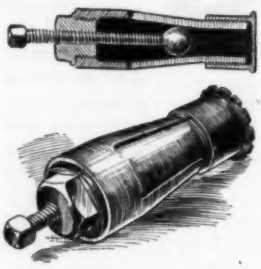
More grain growers would probably place their grain bundles in stacks and allow it to go through a sweat, which is considered better than placing them in shocks, were it not for the work in pitching the bundles on the stack. Although this work is not difficult while the base of the stack is being built, it becomes quite a task when the bundles have to be pitched up a few feet. A Nebraska farmer solved this problem by using his tractor to do the work. A wood chute, 24 in. wide and 24 ft. long, was made, and a wooden roller, fitted in suitable bearings, provided at each end of the chute. The bottom roller, which is 6 in. in diameter, has a pulley attached to it to permit attachment of a belt to the tractor drive pulley. A third roller is arranged under the center part of the chute on a holder, which can be adjusted to tighten or loosen a web belt slipped over the end rollers of the chute. The belt is equipped with a number of slats to prevent the grain bundles from slipping down when the elevator is working. Bundles pitched on the belt at the ground level are carried to the top without any trouble. Using this elevator, it is an easy matter to build a 25-ft. stack quickly.—G. G. McVicker, N. Bend, Nebr.

Pointing Brick Walls

When pointing up a crack in the mortar between bricks, it is necessary to cut out the mortar a little longer than the crack and about ½ in. deep. This should be filled with a half-and-half mixture of cement and clean, sharp sand. In replacing cracked or broken bricks, great care should be taken to see that the brick is firmly bedded into the mortar on all sides, or the wall will leak and eventually settle in that spot.

Reclaiming Grease-Cup Caps

The owner of a garage where I worked was a very thrifty man and saved anything he could find room for, that was not entirely wrecked. Among his favored articles were battered grease cups and their caps. To straighten the latter, we made a simple rig that anyone having a small lathe can duplicate. An expanding screw runs through a steel nut, the nut being threaded on the outside to fit into the expander, which is machined from a piece of cold-rolled steel, and is tapered on the inside. The working end is provided with the same number of threads per inch as the caps to be repaired. Four slits are cut in the expander with a hacksaw. A common steel ball is placed inside for the screw to bear against. This expands the wall against the grease-cup cap. A mallet or soft hammer is then used to restore the cap to its original shape.—Frank N. Coakley, Buffalo, N. Y.

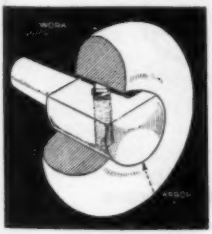


Common Salt Makes Good Filler in Bending Tubing

Sand is generally used as a filler to keep small copper tubing from buckling while it is being bent at sharp angles. If the sand is slightly damp, it will pack at the bend and is then very hard to remove if the tube is not heated. While bending some tubing, try ordinary table salt as a substitute for sand. This can be dissolved in water and washed out if it does not come out readily of its own accord. When washed out, the tubing will be thoroughly free from dirt and the possibility of getting grit in an oil or gas pipe, in case the tubing is to be used on an auto, is entirely eliminated.—H. R. Harrington, Berkeley, California.

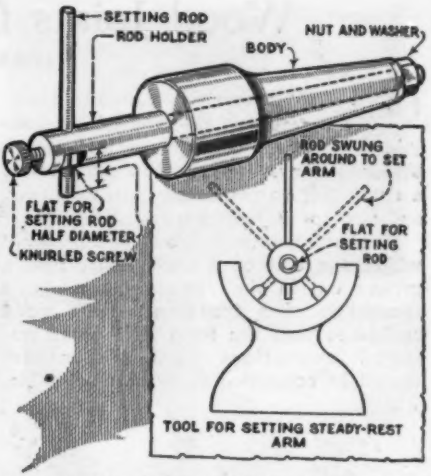
A Screw-Tightening Arbor

For carrying large work on arbors it is necessary to do a good deal of hammering to get the pieces on and off. Much of this work can be better done on a flattened arbor furnished with a screw, as shown in the drawing. To make up for the close space in which the wrench must be turned when adjusting the screw, the latter is finished with two square heads at an angle of 45°, so that it is always possible to get the wrench on one of the heads. For work that is not too wide, one screw will be sufficient, if adjusted in the center of the work. For wide work, two screws may be used, placed near the ends of the work.



Tool for Setting Steady-Rest Arms

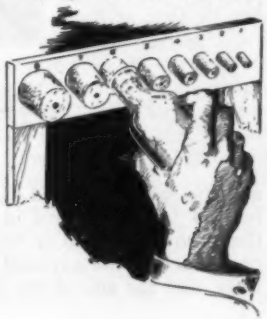
Jobbing shops often receive lathe work that has only one center. This usually means that the steady rest must be used to support the centerless end. To facilitate this work, a repair-shop worker made a handy tool, which consists of a body piece to fit the tailstock spindle, with a rod holder a running fit, and a setting rod sliding through a hole at right angles, the rod being held in place by means of a knurled tightening screw. A flat is milled on the side of the rod holder. When the steady rest is required to be set, the diameter of the work is taken and the rod is set by means of a scale to half of the diameter from the flat to the end of the rod. The rod is then swung around to set the two bottom arms of the rest. The top arm is set when the work is in place.—Harry Moore, Montreal, Can.



Handy Tool for Setting Steady-Rest Arms for Work Having Only One Center

Cork Gauge for Laboratory Workers

For druggists and other laboratory workers, a handy cork gauge can be made by nailing corks of different sizes to a board near the bins in which the corks are kept. When a cork is wanted for a particular bottle, the bottle is first tried on the corks on the board, and after the correct size has been ascertained in this way, it is an easy matter to pick a cork of the same size from the proper bin.—Raymond B. Wailes, Bethesda, Md.



Wood Joints for the Amateur

PART VII

ONE of the commonest joints in everyday practice is the housed or dado joint. It is often used, for example, when fitting the ends of shelves to the sides of a cupboard, or similar piece of furniture, and also for upright partitions.

Its simplest form is shown in Fig. 33, in which the end of a shelf is let into a groove cut in the upright piece. It is somewhat of a tradition among good craftsmen that the form of a joint employed on various parts of furniture should be concealed as much as possible, and the easiest method of doing this on a housed joint is shown in Fig. 34. Here the groove or dado is "stopped" an inch or so back of the exposed edge of the upright, and the end of the shelf is cut back to correspond. When this joint is put together, no trace of the groove is visible from the front. Another advantage, to the amateur, is that any small error in cutting the groove is also invisible from the front. Where one does not want to cut a groove the full thickness of the shelf, the shouldered housing, Fig. 35, may be used. The groove is cut from one-third to one-half the thickness of the shelf, and the end of the shelf rabbeted to fit.

The above joints are usually glued and nailed, the nailing being done from the inside of the joint, and the nails driven down in a slanting direction through the shelf and into the side. If the worker wants to make a job that is a little better, and to produce a joint that will resist an endwise pull on the shelf without the use of nails, the half-dovetail housing, shown in Fig. 36, may be employed. The half dovetail may be cut either on the upper side, as in the larger detail, or on the underside, as at A. A full dovetail, on both sides of the shelf, may also be

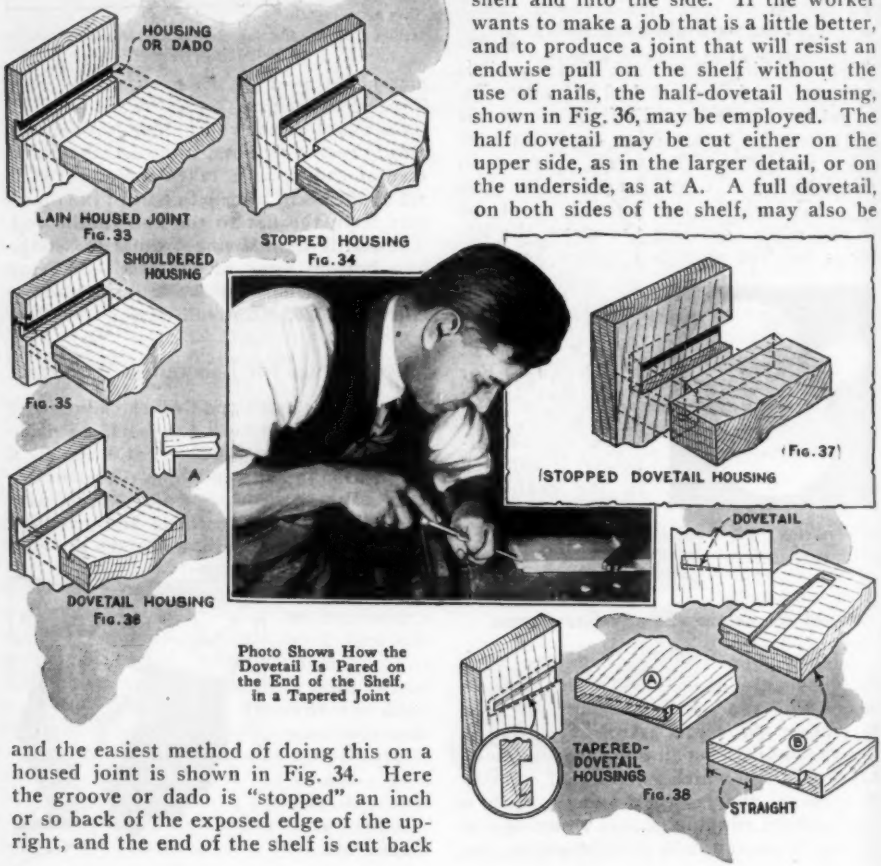


Photo Shows How the Dovetail Is Pared on the End of the Shelf, in a Tapered Joint

used. A dovetail housing may also be stopped, as indicated in Fig. 37, and in this case also, the form of the joint is concealed from the front edge. Joints of this kind are more effective in hard than in soft wood, as in the latter the edges of the dovetails are likely to crumble.

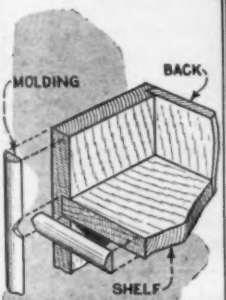


Fig. 39

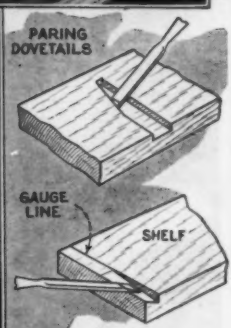


Fig. 41

Above, Routing Bottom of Housing; Below, Paring Dovetailed Housing

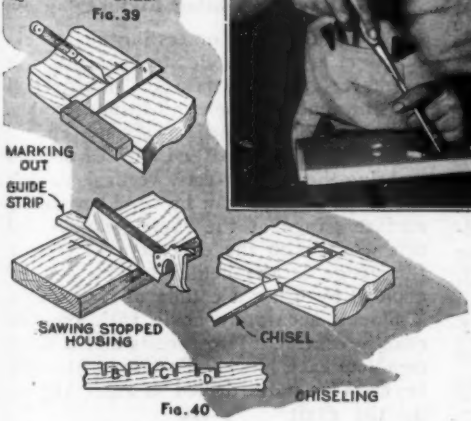


Fig. 40

The bevels of the dovetails should not be too acute, or the joint will be weak.

Fig. 38 shows two good forms of the housed joint, which are not only half-dovetailed, but are also tapered from back to front, and stopped. In detail A, the joint is tapered all the way from front to back, and in B the lower edge of the joint is straight for about half the width of the board, the remainder being dovetailed and tapered. In both joints, the upper edge of the joint is square across the boards. These joints demand careful setting out and cutting, but make a very stiff joint. In construction of the type employing housed joints, the rear of the piece is usually fitted with a panel or matchboard back, and this holds the shelves forward. These are glued joints, no nails or screws being necessary.

Fig. 39 shows a neat way to finish off a job employing through dadoes, by tacking half-round molding on the edges of shelf and upright.

When laying out for housings, follow the procedure shown in Fig. 40. Mark with square and knife; saw down to the depth marks, using a guide strip tacked to the piece, then cut the waste out with the chisel, taking the cuts on the corners of the waste first, and finally in the center, as shown at B, C and D. Through dadoes can be planed out with a dado plane, but stopped dadoes will usually be found easier to cut by the method shown. The bottom of the dado should be dressed down level with the router, if one is available. Sometimes a shallow hole, to the depth of the dado, is drilled in the end of the groove as shown in one detail. When

cutting tapered-dovetail housings, make the chisel cuts on the tapered part vertical at first, remove the waste, then pare the dovetail as shown in the upper drawing, Fig. 41. The mating piece is pared to fit as shown in the lower drawing. Note that the angle of the dovetail tapers off toward the straight part, in both pieces.

How to Cure Hens of the Flying Habit

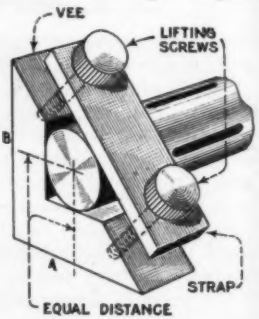
Complaints of neighbors against poultry owners are frequently caused by the flying habit of one or more hens of a flock. Sometimes the owner resorts to wing clipping, but this practice not only mutilates the plumage but also deprives the bird of sufficient body protection. The wing feathers cover a vital part, exposure of which to either heat or cold may result in sickness and death. A California poultryman cures the flying habit by tying the six flight feathers of a wing with a cord, as shown in the photo. By the time the cord wears off, the bird is completely broken of the habit.

Making Blueprints from Heavy Paper

Often it is desired to make a blueprint from a drawing made on heavy paper or Bristol board, without tracing. The main reason for wanting such a print is usually that a copy is desired for filing, to provide a temporary reference, or as a duplicate if the original is lost, in which case a reversal is no serious objection. The blueprint is made in this manner: Place the drawing in the frame with the ink in perfect contact with the sensitized surface of the printing paper, to preclude the possibility of blurring due to dispersion of the light in passing through the thick paper. To get a clear-cut reproduction, it is merely necessary to increase the length of the exposure sufficiently to compensate for the reduction in the intensity of the light due to passing through the extra thickness. If the drawing bears considerable lettering and would be very inconvenient in a reversed form, it can be easily read by holding it up to the light and viewing it from the back or by reading it as reflected in a mirror. A rather interesting variation of this method of printing that gives an unreversed copy, but of less sharpness, consists in placing the back of the sensitized paper in contact with the inked surface of the original and then exposing the back of the latter to the light. In this manner, the only dispersion that occurs is that occasioned by the passage of light through the body of the blueprint paper, and when this is of the thin mailing variety, very good results are obtained.

Keyway-Testing Fixture

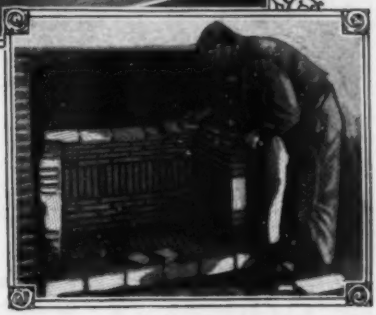
When laying off or testing shaft keyways set at right angles to each other, it is general practice to use V-blocks and find the center of the work from the table. Then a line is scribed across the end of the shaft, and the latter is turned around to bring the line perfectly vertical, so that the other keyway can be tested with the surface gauge at the same height. All this work, with the exception of setting the gauge at the center height, can be avoided by using a couple of right-angle V-blocks, accurately made with the vee exactly central. Two screws and a strap complete each block. To test right-angle keyways or holes drilled at right angles, lay the shaft in the vees and clamp just enough to hold it. Now set the surface gauge to the center height and set one keyway central from side A. Then lay the blocks on side B, to test the machining at right angles to the first test. The fixture can easily be adapted to the machining of the keyways also.



Copyright, Popular Mechanics

Plan No. 5-W-12

Chimneys Are Now Being Worn in Front



CHIMNEYS, like modern bathrooms and decorative kitchens, have stepped out into society, so to speak. They are now being worn in front. You've noticed how chimneys have slowly but surely moved from their original position at the rear of the house to the sidewall, until today you find them as highly ornamental features on the front of every other new house built.

Seldom if ever do you find two chimneys alike. Some are jazzy and theatrical. Others are restrained and severely plain. Many strange and interesting combinations of materials are worked into chimneys. Fieldstone, brick, cement, stucco, tile, bottle glass, horseshoes, initial letters, and other things of sentimental and historic interest, are employed in chimney design. Sentimental features which have surrounded the fireplace inside the house are now used to dress up the chimney outside the house. And why should it not be so? Sentiment, after all, is perhaps the main reason why people build houses.

Speaking of sentiment, Charles Dudley Warner once said, "the best artist that ever lived could not paint the family at home sitting around a radiator. But any second-rate artist could do a perfectly good job portraying all the sentiment of 'Home Sweet Home' by grouping the family around a fireplace." So much for the sentimental and ornamental side of chimneys and fireplaces.

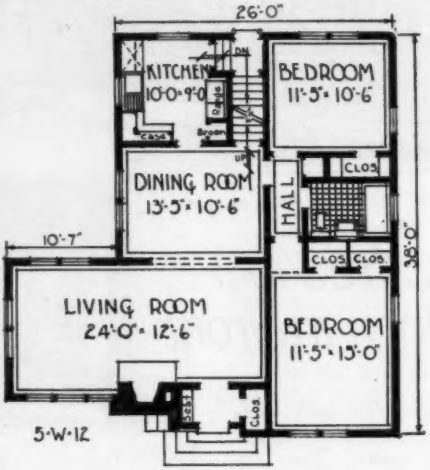
Speculative builders say that chimneys and fireplaces are important fac-

HOW TO GET A BLUEPRINT

To help our readers get started on one of life's most glorious experiences—building and owning a home—Popular Mechanics Magazine will supply readers a one-sheet blueprint of any house appearing in the magazine for $1. This blueprint does away with the necessity of first purchasing a complete set of plans to find out whether you can afford to build. It contains floor plans, elevations, a section detail, size of joists, studs, etc., and also a brief specification. Submit it to tradesmen and dealers for building estimates.

tors in selling houses. That may be another reason why they are now worn out in front.

Take the attractive little house illustrated this month. The chimney is a dominant feature of the exterior design. Done in native fieldstone of gray and brown, it contrasts nicely in texture and color with the stained edge-grain cedar shingles on roof and sidewalls. Above the entrance door is a touch of stucco. This adds still more interest to a highly decorative and well-planned color scheme.



And now let's study the plan. First notice the general appearance of this house. Note how it nestles close to the ground. You feel it is a part of the landscape. This is as it should be. Far too many houses are perched high on basement walls and appear to be strutting around on stilts and top-heavy.

There are five good rooms on the first floor and space for two extra sleeping rooms on the second. In other words, you have bungalow equipment below and the house may grow later on, if you need more space. This has advantages. People who buy houses generally want three bedrooms. You have more than three here, even though you finish the first floor and let the second floor go until a buyer shows up.

The living room is of special interest. It is practically one-half glass. This gives you a combined sunporch and living room. The house is frame construction, fully insulated, and will require a lot at least forty-five feet wide. There is a full basement. The design will look well in brick or stucco. The general lines lend themselves well to all materials.

Roughly speaking, this is a $5,500 house under normal conditions. Near large cities the cost to build will be higher. It will also be increased if you use expensive equipment. If you do not finish the second floor, there will be some not inconsiderable saving.

A word about wood shingles, because this is a shingle house. Shingles are made two ways. One is to cut them toward the center of the tree so that the annual rings will be parallel on the face of the shingle. These shingles are called "edge-grain." They are really quartersawed like the best oak floors. They wear well and lie flat. In the long run, they are the least expensive shingle to buy. The other kind may be cut flatwise of the tree like rough lumber is made. These are the cheaper grades.

Shingles should be thick. Not less than two-fifths of an inch at the butt end and laid a slight distance apart. The exposed width should be as great as you can afford. Don't lay shingles with ordinary wire nails. A good shingle will outlast a wire nail many years. Use rust-resisting nails made from galvanized cut iron or zinc-coated nails. It's a waste of money to buy edge-grain shingles and use cheap nails.

Stains in almost every color used on shingles give you a wide selection for texture, pattern and color effects. They act as a preservative. You can't go wrong by using a shingle roof or sidewall, and, in cost, a shingle house is about the least expensive you can build these days.

PLAN BOOKS FOR READERS

A NEW BUNGALOW BOOK: Sixteen selected low-cost bungalows in popular styles, at prices ranging from $5,000 down to $2,000. Each house fully described and illustrated. Send ten cents in stamps to cover mailing.

TWENTY POPULAR LOW-COST HOMES AND TEN COMMANDMENTS FOR HOME BUILDERS AND BUYERS: Selected houses showing a variety of types, styles, materials and sizes. Some as low as $2,000. Send ten cents in stamps to cover mailing Address Building Editor.